AMSAA

TECHNICAL REPORT NO. 570

ANTI-ARMOR ADVANCED TECHNOLOGY DEMONSTRATION (A2 ATD)

VERIFICATION, VALIDATION AND ACCREDITATION

(VV&A) TOOLS

FOR SIMULATORS

March 1995

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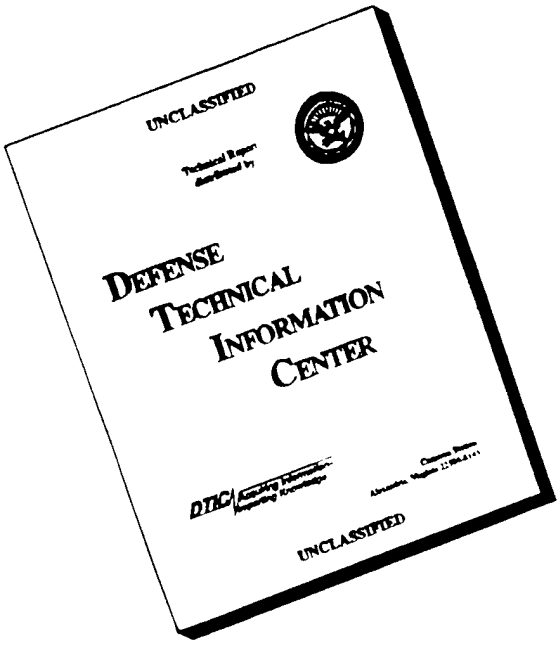

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13. ABSTRACT *(Maximum 200 words)*

The Anti-armor Advanced Technology Demonstration (A2 ATD) is a series of Battlefield Distributed Simulation - Developmental (BDS-D) experiments focusing on A2 weapon systems evaluations. A2 ATD Experiments consist of a combination of one or more simulators coupled with modular semi-automated forces (MODSAF). Each combination requires Verification, Validation and Accreditation (VV&A) of: individual simulators, MODSAF, and the entire BDS-D simulation. Under the A2 ATD program, methodologies and tools have been designed and developed to assist in the VV&A process of individual simulators,MODSAF and the BDS-D simulation. This report outlines and describes the VV&A methodologies and tools developed and demonstrated for an individual simulator.

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Anti-armor Advanced Technology Demonstration, A2 ATD, Verification, Validation, Accreditation, VV&A, Distributed Interactive Simulation, acquisition process, simulators

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LIST OF ACRONYMS

AGS	- Armored Gun System
AMSAA	- Army Materiel Systems Analysis Activity
APC	- Armored Personnel Carrier
ATMT	- Anti-Tank Missile Test
A2 ATD	- Anti-Armor Advanced Technology Demonstration
BDS-D	- Battlefield Distributed Simulation - Developmental
CASTFOREM	- Combined Arms and Support Task Force Evaluation Model
CIG	- Computer Image Generator
CITV	- Commander's Independent Thermal Viewer
DIS	- Distributed Interactive Simulation
DISAT	- DIS Analytical Tools
DVO	- Direct View Optics
FLIR	- Forward Looking Infrared
FOR	- Field of Regard
GPS	- Gunner Primary Sight
IFOV	- Instantaneous Field of View
IOTE	- Initial Operational Test and Evaluation
LOSAT	- Line-of-Sight Anti-tank
MODSAF	- Modular Semi-Automated Forces
NFOV	- Narrow Field of View
NLOS	- Non-Line-of-Sight Anti-tank
PDU	- Protocol Data Unit
SIMAN	- Simulation Manger
STRICOM	- Simulation, Training and Instrumentation Command
TIS	- Thermal Integrated Sight
VV&A	- Verification, Validation and Accreditation
VVATT	- VV&A Test Tool
WFOV	- Wide Field of View

1. BACKGROUND

Historically, the analytical community has used constructive models such as Janus and the Combined Arms and Support Task Force Evaluation Model (CASTFOREM) to conduct analysis for the acquisition process. These types of models do not fully represent the impacts of human interaction with the system and the human influence on combat effectiveness of the system. The Training and the Research and Development communities have used real time man-in-the-loop Distributed Interactive Simulation (DIS) for several years. However, the full potential of DIS as an evaluation tool to support materiel acquisition decisions has not been realized.

The purpose of the Anti-armor Advanced Technology Demonstration (A2 ATD) is to develop and demonstrate a verified, validated, and accredited (VV&A) DIS capability to support anti-armor weapon system virtual prototyping, concept formulation, requirements definition, effectiveness evaluation, and mission area analysis on a combined arms battlefield at the battalion task force or brigade level.

The Battlefield Distributed Simulation - Developmental (BDS-D) simulation's synthetic environment represents the current state-of-the art in DIS. Upgrades to the environment, simulators, data analysis tools, and verification, validation, and accreditation are required to make BDS-D simulation a viable tool for supporting acquisition decisions. The BDS-D Advanced Technology Demonstration (ATD) is upgrading the environment and has taken the first step in verification, validation, and accreditation of the modular semi-automated forces, which simulates the computer generated forces. In addition, simulators being developed will have next generation hardware and also require verification, validation, and accreditation.

The A2 ATD technical objectives are:

1.) Demonstrate DIS as an evaluation tool and verify, validate, and accredit simulators used in the A2 ATD experiments, modular semi-automated forces (MODSAF), and the BDS-D simulation.

2.) Develop, demonstrate, and document analytical tools (techniques) to evaluate the causes of simulation outcomes.

3.) Demonstrate the linkage of constructive models (Janus and Eagle) to DIS.

4.) Demonstrate upgraded virtual prototypes (M1A2 Abrams, M2A3/M3A3 Bradley, Line of Sight Anti-Tank (LOSAT), Non-Line of Sight (NLOS)) and virtual prototypes to be developed (Comanche, Apache, Armored Gun System (AGS), Javelin).

Simulator and semi-automated forces verification, validation, and accreditation and development of analytical tools to support the evaluation of causes of simulation outcomes were initiated in FY93 to provide the foundation for six experiments in FY94, FY95 and FY96. The first FY94 experiment replicated two M1A2 Initial Operational Test and Evaluation (IOTE) vignettes to validate the BDS-D virtual simulation for the M1A2 based upon simulations of the real tanks at Ft. Hood (IOTE). Experiments 2, 3, and 5 evaluate heavy force anti-armor modernization and validate the MODSAF representations of the M1A2, M2A3/M3A3, LOSAT, NLOS, Comanche, Apache and M1A2 firing Smart Target Acquisition Fire and Forget (STAFF) in High Resolution Scenario 29 in Southwest Asia. Experiment 4 demonstrates Janus linked to BDS-D and evaluates Janus as an alternative to the Modular Semi-automated Force (MODSAF). Experiment 6 evaluates light force anti-armor modernization and validates MODSAF representations of Javelin, LOSAT, NLOS, Comanche and Apache.

2. VERIFICATION, VALIDATION AND ACCREDITATION OF MODELS, SIMULATORS AND SIMULATIONS

VV&A is required for models, simulators and simulations (MS and S) that are used to support ASARC/DAB programs. Figure 1 shows an overview of the VV&A process.

Verification: is the process of determining that the MS or S accurately represents the developer's conceptual description and specifications.

Validation: is the process of determining the extent that the MS or S represents the intended real world entity.

Accreditation: is an official certification that the MS or S has achieved an established level of credibility such that it can be used for a specific application.

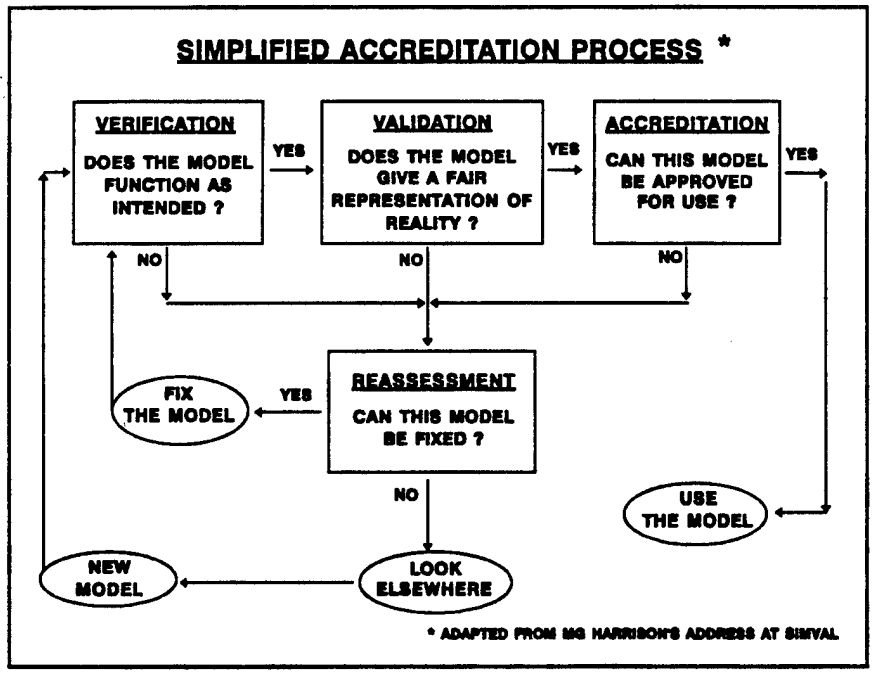

Figure 1 Simplified VV&A Process

The Battlefield Distributed Simulation - Developmental (BDS-D) is a simulation consisting of a combination of one or more simulators, modular semi-automated forces (MODSAF) and/or live systems. Each combination of simulators, MODSAF and live systems represents a unique simulation that requires Verification, Validation and Accreditation (VV&A). BDS-D VV&A requires VV&A of:

1.) individual simulators,

2.) MODSAF, and

3.) the BDS-D simulation.

The Anti-armor Advanced Technology Demonstration (A2 ATD) is focusing on the class of BDS-D applications that support A2 weapon systems evaluation. In support of the A2 ATD program, methodologies and tools have been designed and developed to assist in the VV&A process of individual simulators, MODSAF and the entire BDS-D simulation. In FY94 these methods and tools have also been demonstrated during VV&A of the M1A2 simulator, MODSAF version 1.2.3 and the A2 ATD Experiment 1. Experiment 1 was a BDS-D simulation using M1A2 simulators and MODSAF to replicate the M1A2 Operational Test at Ft. Hood.

The VV&A tools for the M1A2 simulator transfer well to other weapon systems/simulators. For example, nearly all weapon systems/simulators require a gunner to detect, recognize and identify targets; therefore, the M1A2 simulator VV&A methodology and tools developed to capture target acquisition capabilities are transferable.

3. PURPOSE

The purpose of this document is to outline and describe the VV&A tools developed for an individual simulator.

4. SIMULATOR VV&A TOOLS

The A2 ATD program requires VV&A of individual simulators. Since the purpose of A2 ATD centers on weapon systems evaluations, then the VV&A tools are also geared toward that end. Four of the VV&A tools were designed and developed under A2 ATD and the fifth tool, the Simulation Manger (SIMAN) was developed by STRICOM in order to control BDS-D simulations. However, A2 ATD used the SIMAN to assist in the VV&A. The five tools are:

1.) VV&A Test Tool (VVATT), for target acquisition experiments,

2.) VV&A Protocol Data Units (PDUs),

3.) Delivery Accuracy Logger Files,

4.) DIS Analytical Tools (DISAT), and

5.) Simulation Manager (SIMAN)

The following sections describe each one of these tools.

4.1 VV&A Test Tool (VVATT)

A2 ATD developed the VVATT to assist in the conduct and analysis of target acquisition tests for the M1A2 simulator. Two types of stationary target acquisition tests are supported:

1.) One tests the acquisition capability in the Instantaneous Field of View (IFOV), and

2.) the other tests the acquisition capability in a Field of Regard (FOR), i.e. search.

Tests are conducted at various ranges through each sensor (e.g. DVO, FLIR, etc.) coupled with a field of view type (e.g. narrow, wide, zoom, etc.). Figures 2 through 7 and Appendix A contain a sample of some of the VVATT menus and reports.

Prior to conducting a target acquisition test, the test conditions must be created. Figures 2 and 3 show the VVATT's Create Observer (i.e. simulator) and Create Target menus, respectively. The data entered into these menus can be obtained by first determining observer and target positions from MODSAF. A number of observer-target pairs are entered into the VVATT. Additionally, the test design involves range bands. Figure 4 shows an example of range band break-outs. This data is used by the VVATT to verify that the observer-target pairs are within the test range bands. For a FOR test, boards to mark the left and right boundaries for the field of regard/search are also entered on another menu screen. After the target acquisition test cases are input to the VVATT, then the test may be conducted.

The VVATT, in conjunction with the simulator, is used to execute a target acquisition test. Figure 5 shows the first VVATT menu. Here the observer's/soldier's personnel information is entered. When "Go" is depressed, the sequence of observer-target pairs will be executed and the acquisition data menu appears on the VVATT. The simulator is positioned at a particular location on the virtual battlefield and the target appears at a predefined location. In an IFOV test, the soldier looks through the sight and attempts to acquire the target at the highest level of acquisition that he can discern. Acquisition levels in ascending order are: no target, detection, recognition - target class, and identification - target nomenclature. The acquisition data menu, Figure 6, contains the choices of soldier acquisition responses. Furthermore, the soldier will also state which partitioned segment of the sight, Figure 7, the target appears in. In the FOR test, the soldier searches for a target in an area delineated by

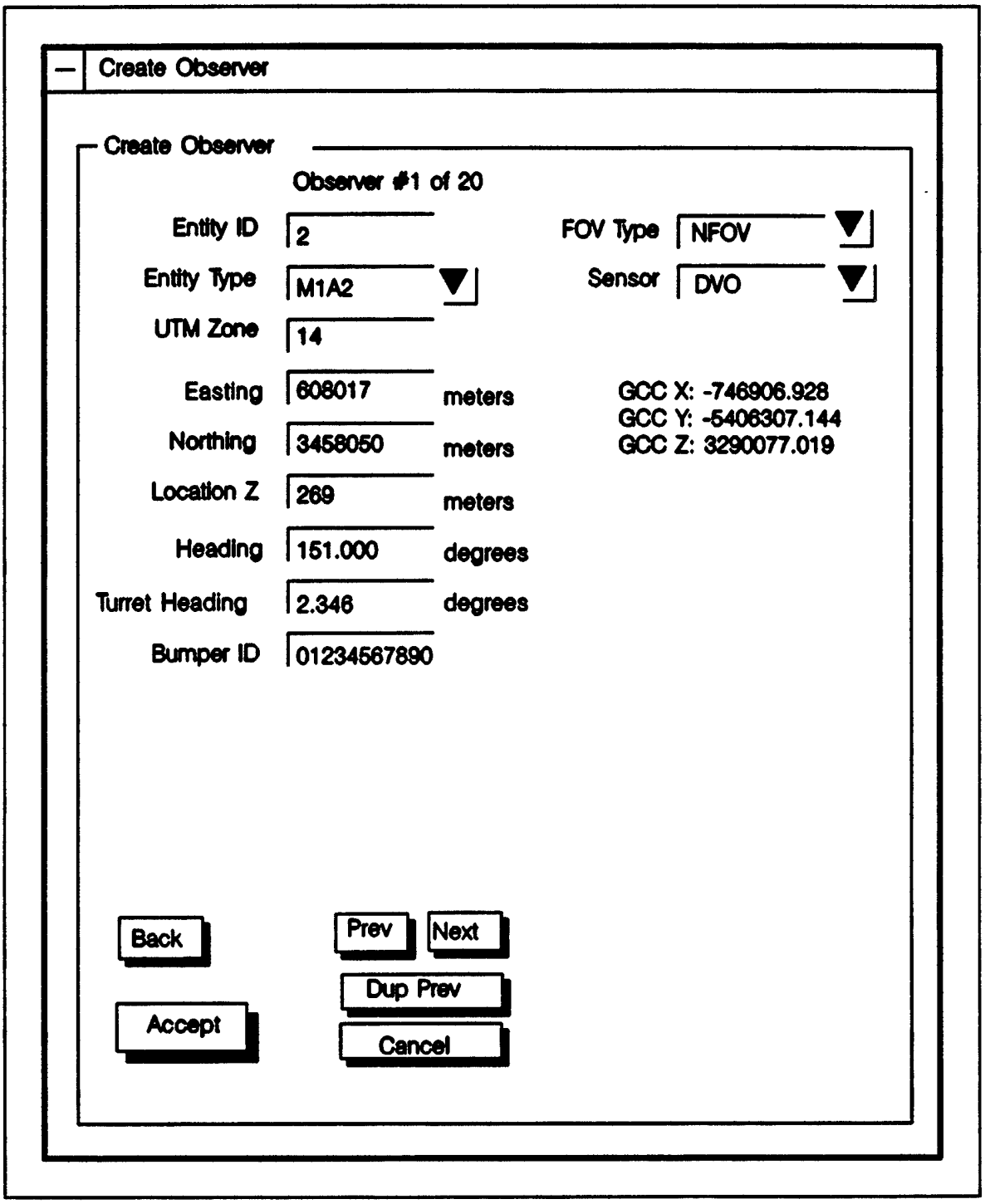

Figure 2 Create Observer Menu

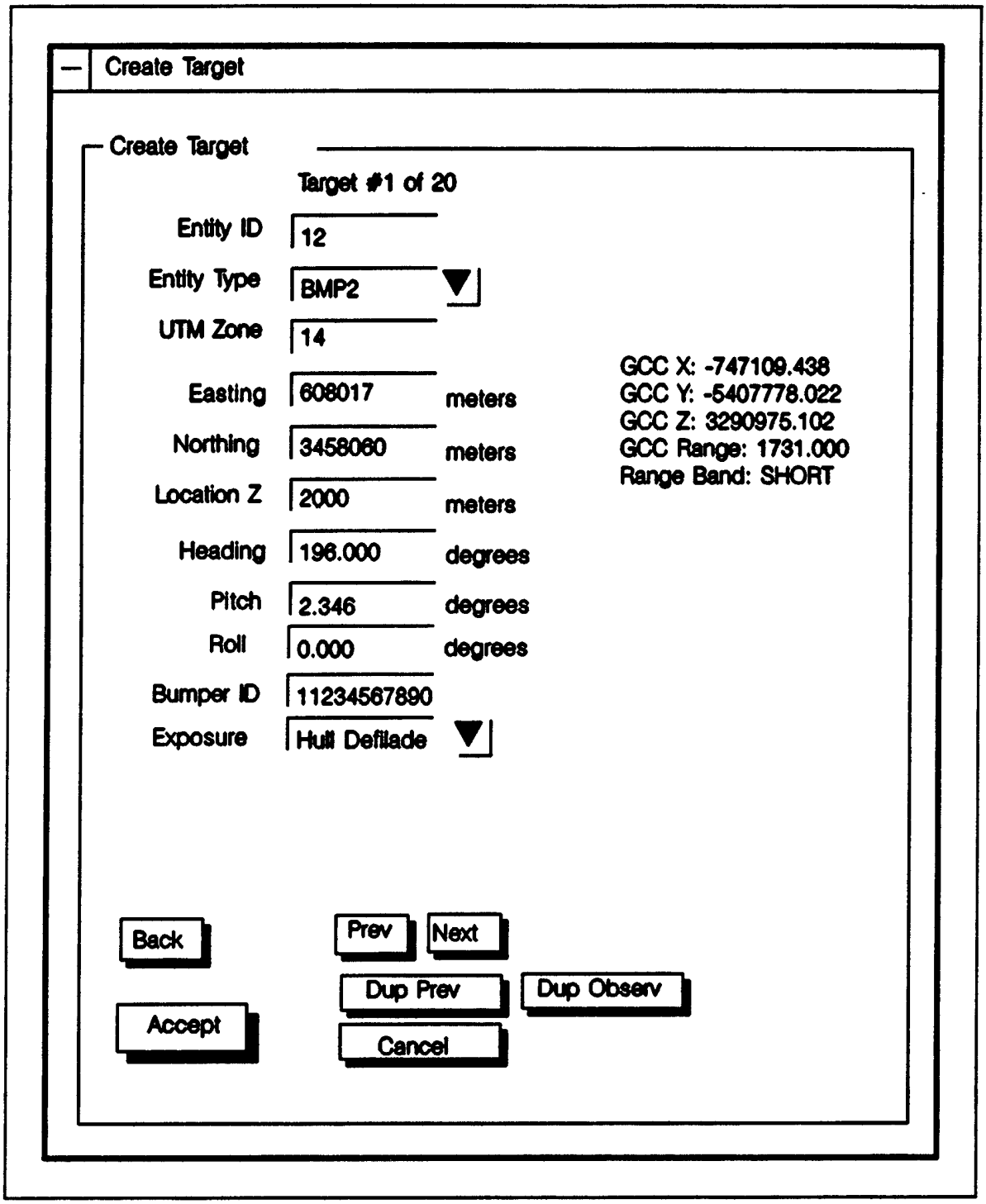

Figure 3 Create Target Menu

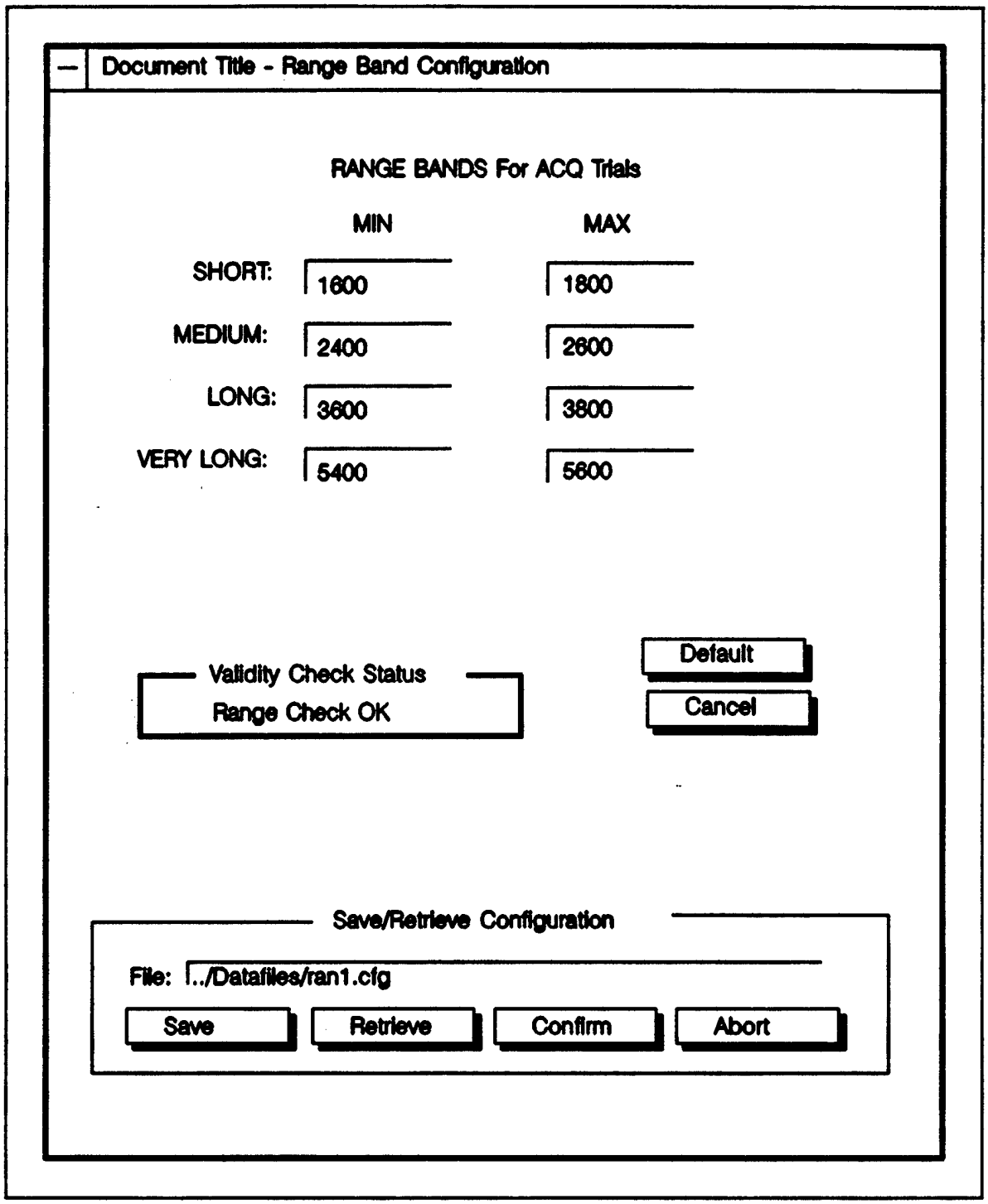

Figure 4 Range Bands Menu

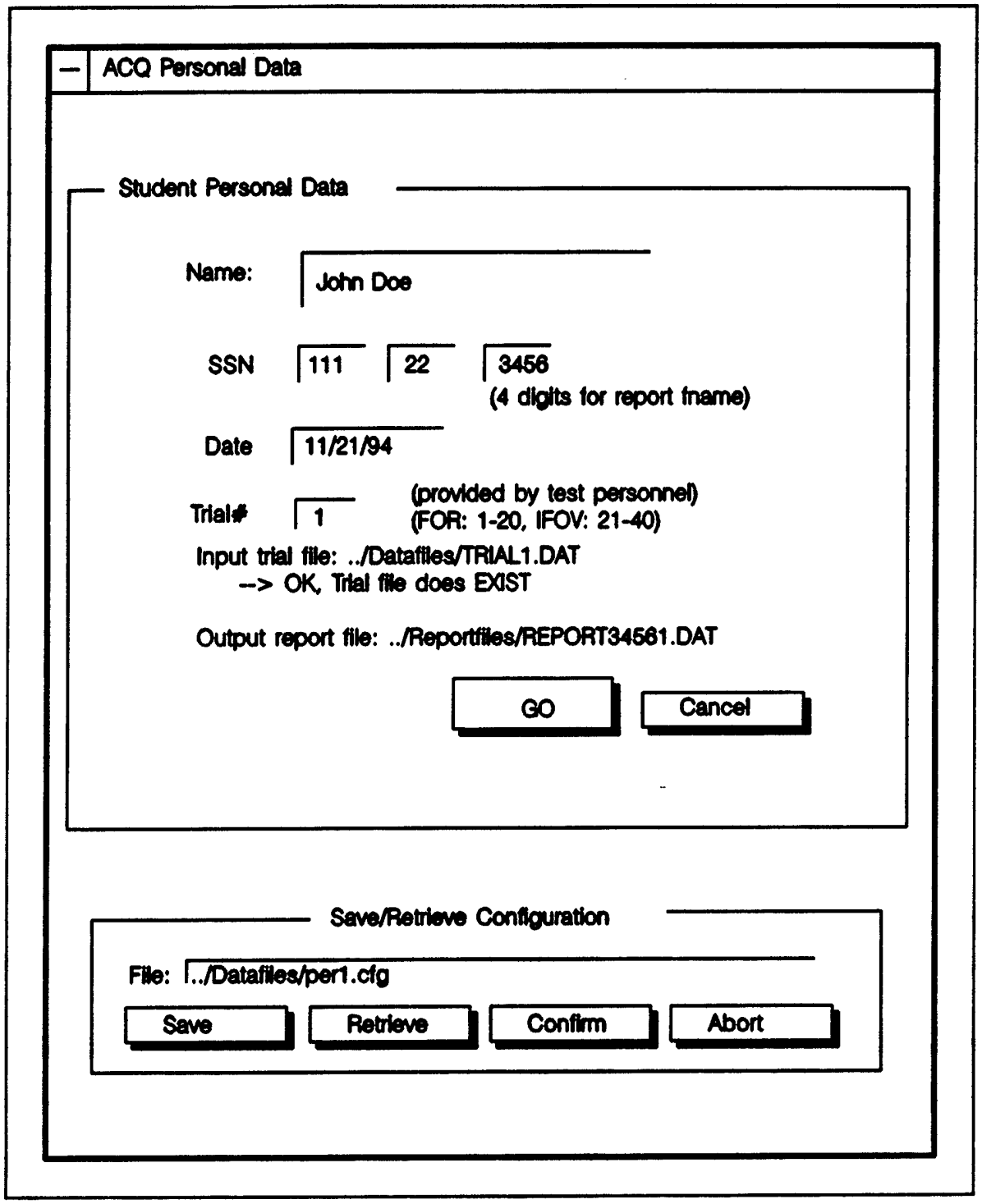

Figure 5 Personnel Data Menu

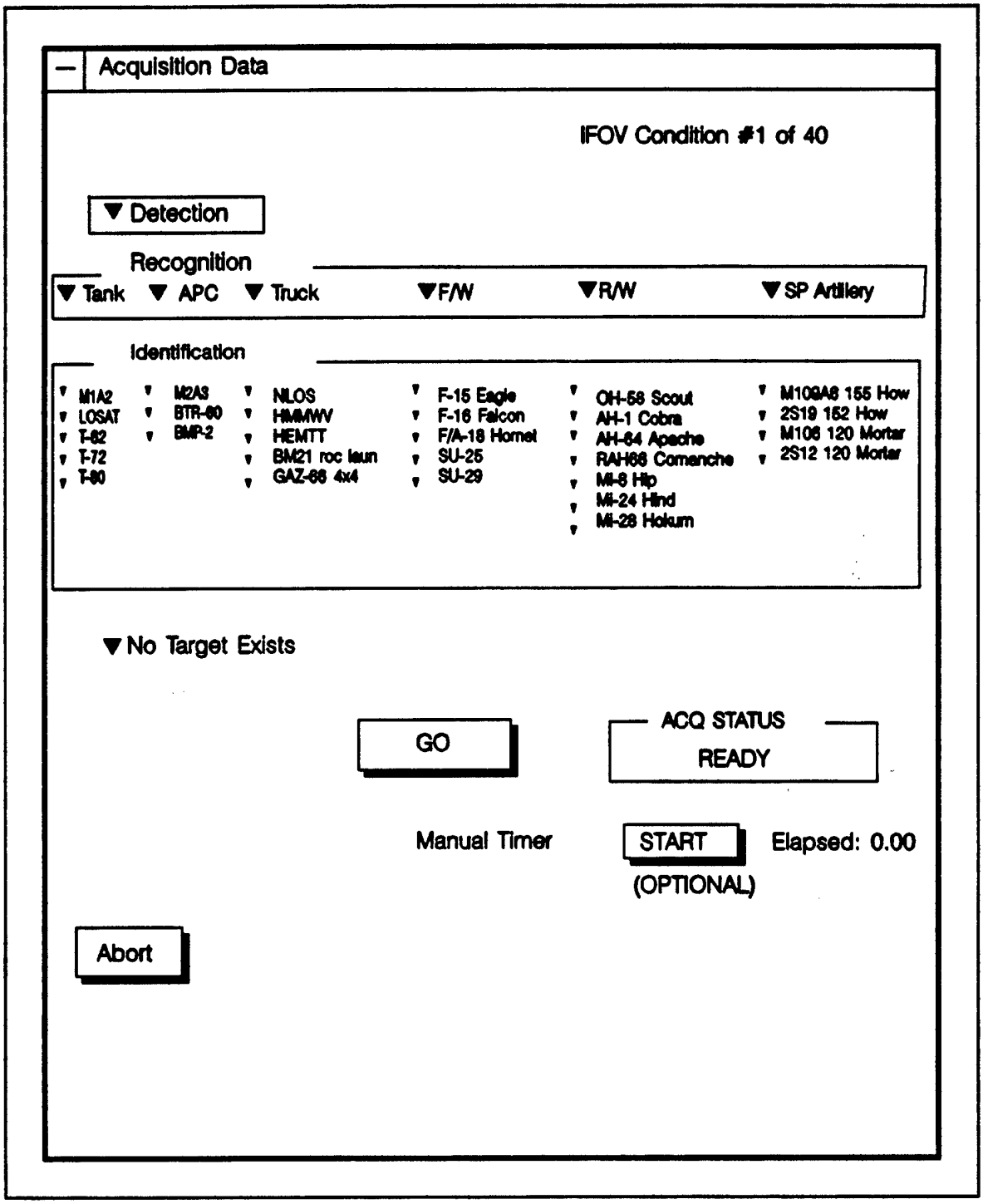

Figure 6 Acquisition Data Menu

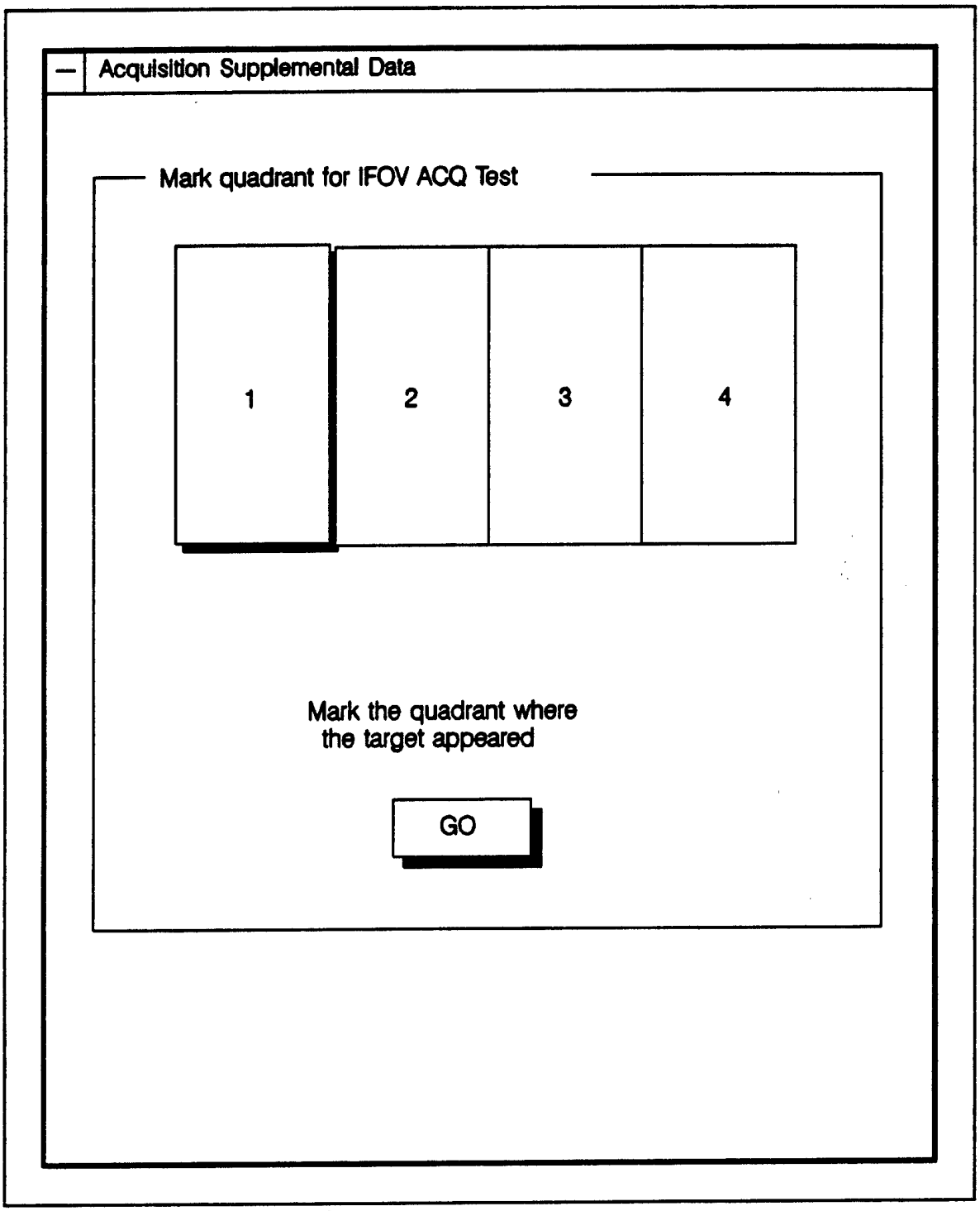

Figure 7 Quadrant Data Menu

the left and right board markers. When he locates a target, the soldier states the acquisition at the highest level he can distinguish. For both IFOV and FOR tests, a stop clock tracks the time elapsed between target appearance and the soldier's response. After the target acquisition test trials are completed, the VVATT produces a report.

Appendix A pages A-2 through A-11 show the output results. Each individual observer-target pair is tracked and scored. Accounting scores for observer responses versus ground truth are maintained for detection, recognition, identification, false targets, null targets and time. Near the end of the report, summary data is produced. A sample is contained on pages A-10 and A-11.

The VVATT assists in rapidly stepping through structured target acquisition tests, scoring and summarizing the results.

4.2 VV&A Protocol Data Units (PDU's)

A PDU is a unit of data that is passed on a network between simulation entities or applications. Standard PDU's are defined by the Distributed Interactive Simulation (DIS) Community. VV&A PDU's are specialized PDU's generated by the simulator. Actually, the VV&A PDU's are not separate PDU's, but are wrapped inside an Action Response PDU customized for each VV&A category. The VV&A PDU's contain data that cannot be derived from the Standard DIS PDU's; the VV&A data contains intermediate and final calculations that the simulator must determine in order to function/operate correctly.

Six VV&A PDU's were designed, developed and used in the M1A2 simulator. These PDU's transfer well to other weapon platforms; however additional PDU's may be necessary to VV&A other weapon systems which exhibit special characteristics. Currently there are six VV&A PDU's and the structure/data fields of these PDU's are contained in Appendix B. The following briefly describes each PDU:

1.) Target Acquisition and Tracking PDU. The Target Acquisition and Tracking PDU is transmitted periodically at time intervals. From the structure contained in Appendix B, it is apparent that this information is used to analyze target tracking ability for a delivery accuracy evaluation. This PDU data can also be used to analyze search patterns for a target acquisition evaluation.

2.) Delivery Accuracy PDU. The Delivery Accuracy PDU is transmitted when a round is fired. The data in this PDU is used to conduct a delivery accuracy evaluation. This PDU is used in conjunction with the Target Acquisition and Tracking PDU in order to conduct delivery accuracy evaluations for the Sabot and HEAT rounds.

3.) Direct Fire Vulnerability PDU. The Direct Fire Vulnerability PDU is generated when the simulator receives a hit from a round. The data in this PDU provides the information to conduct an analysis regarding the direct fire vulnerability algorithms for kinetic energy, shaped charge and top-attack direct fired munitions.

4.) Indirect Fire Vulnerability PDU. The Indirect Fire Vulnerability PDU is generated when an indirect fire round detonates with a certain radius of the simulator. The information provides the ability to analyze the simulator's indirect fire algorithms for both high explosive and ICM type artillery rounds.

5.) Smart Target Acquisition Fire and Forget (STAFF) PDU. The STAFF PDU is generated when the simulator fires a STAFF munition. This PDU contains data which is customized to the STAFF munition. The STAFF round is a fire and forget round equipped with a seeker. Once a target is located by the STAFF munition, then the STAFF fires a submunition down onto the target. For analysis, the STAFF PDU is used to assess the STAFF round delivery accuracy and STAFF submunition functioning.

6.) Coax Machinegun PDU. The M1A2 simulator generates a Coax PDU when a 7.62mm tracer round is fired. A tracer round occurs on every 5th round of 7.62mm munition. The simulator models the tracer round in order to reduce the total number of packets which would be required if each round were modeled. This approach was chosen because of the 7.62mm coax machinegun's rapid firing rate. The Coax PDU contains data relative to a burst-fire weapon system. This PDU is used to evaluate the 7.62mm delivery accuracy.

The various VV&A PDU's can each be turned-on or turned-off. The capability of turning off the VV&A PDU's is necessary before conducting a BDS-D Experiment. There is concern that the Standard DIS PDU's generated during an Experiment could overload the network. Therefore, additional data/information generated by the VV&A PDU's simply add more packets on the network which potentially may cause network/real-time problems.

The VV&A PDU's were designed specifically for the M1A2 simulator; however they are sufficiently general that they may be used to capture the same data for nearly all ground platforms. The Target Acquisition and Tracking PDU is applicable to any weapon system that manual searches and tracks targets. This PDU could possibly also be used for automatic tracking. The Delivery Accuracy PDU may apply to any weapon system simulator that fires a round and uses biases and dispersion to model the fly-out. The Direct Fire Vulnerability and Indirect Fire Vulnerability PDU's are applicable to any simulator that uses the standard Army vulnerability algorithms. The Staff PDU may be used for other fly-over shoot-down type munitions. And finally the Coax PDU may be applicable to other burst-fired munitions.

4.3 Delivery Accuracy Logger Files

Prior to the A2 ATD Experiment 1, the delivery accuracy capability of the M1A2 simulator firing sabot and High Explosive Anti-Tank (HEAT) rounds was VV&A'd. Tests similar to the Technical Tests conducted on live M1A2 tanks at the Proving Ground were re-created in the virtual battlefield environment. Four major test scenarios are:

1.) stationary firer versus stationary targets,

2.) stationary firer versus moving targets,

3.) moving firer versus stationary targets, and

4.) moving firer versus moving targets.

The virtual test set-ups are created with logger files, which are comprised of PDU's. The M1A2 simulator is separately placed on the battlefield by use of the simulator console. During simulator delivery accuracy testing, the logger files are played back on the Datalogger while the soldiers in the simulators engage targets. Figures 8 through 11 graphically show the various delivery accuracy target board set-ups.

Figure 8 contains the stationary firer versus stationary target-board test. Four separate logger files were developed to place the eight collective target-boards at 1500, 2500, 3000, and 3500 meters range from the simulator. One logger file at a time is played back, while the gunners fire two sabot rounds at each target in sequence. Next, two HEAT rounds are fired at each target. Then, the 2500 meters logger file is played and the sequence continues until the last logger file is played back and engaged.

The stationary firer versus moving target-board tests are shown in Figure 9. One moving target is a crossing target and the other moving target is an evasive maneuvering target replicating the Anti-Tank Missile Test (ATMT) path. For the crossing target, three logger files were developed for target ranges of 1500, 2000 and 2500 meters distance from the simulator. The 1500 meter logger file is played back. After the target passes the marker; then the soldiers fire 2 sabot and 2 HEAT rounds. That same logger file is played back a number of times to obtain sufficient replications. Next, the 2000 meter logger file is engaged and replicated, followed by the 2500 meter logger file. In the case of the stationary firer versus maneuvering target, three logger files were developed for target ranges of 1500, 2000 and 2500

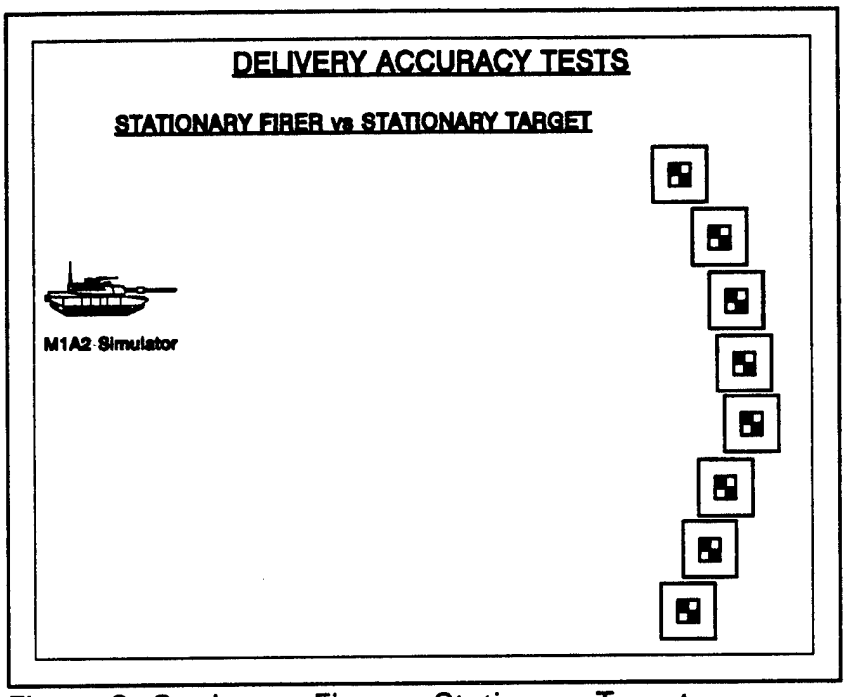

Figure 8 Stationary Firer vs Stationary Target

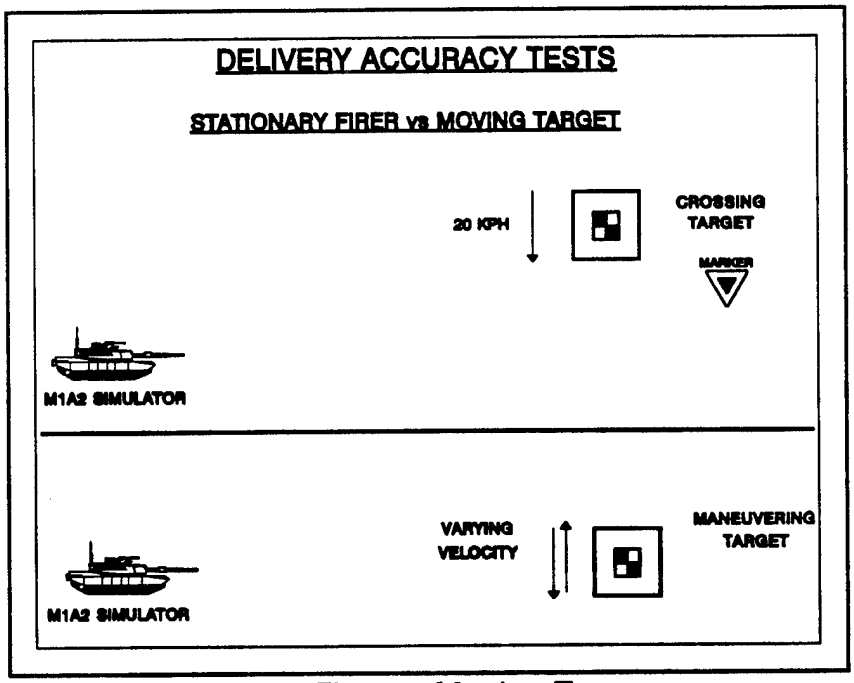

Figure 9 Stationary Firer vs Moving Target

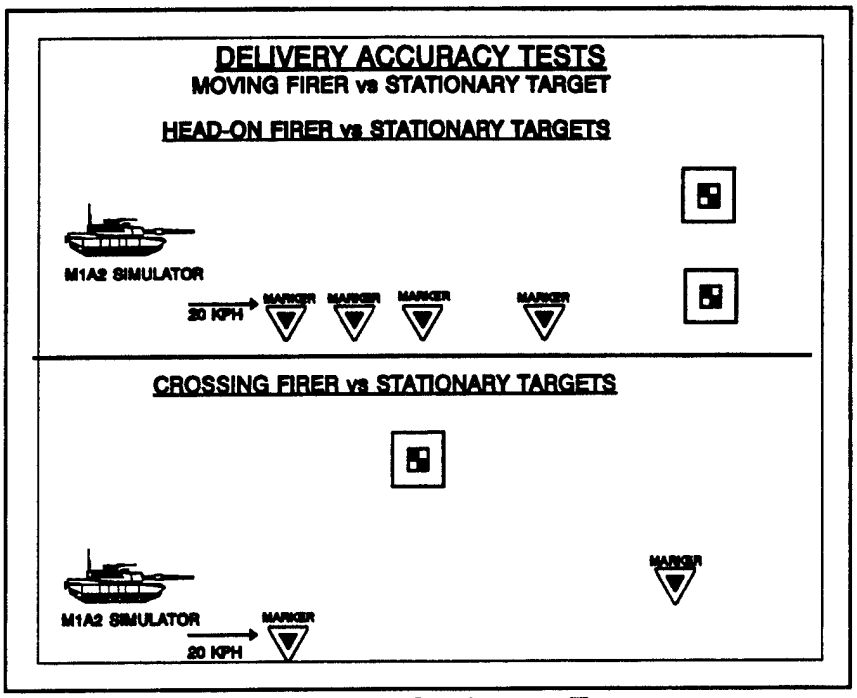

Figure 10 Moving Firer vs Stationary Target

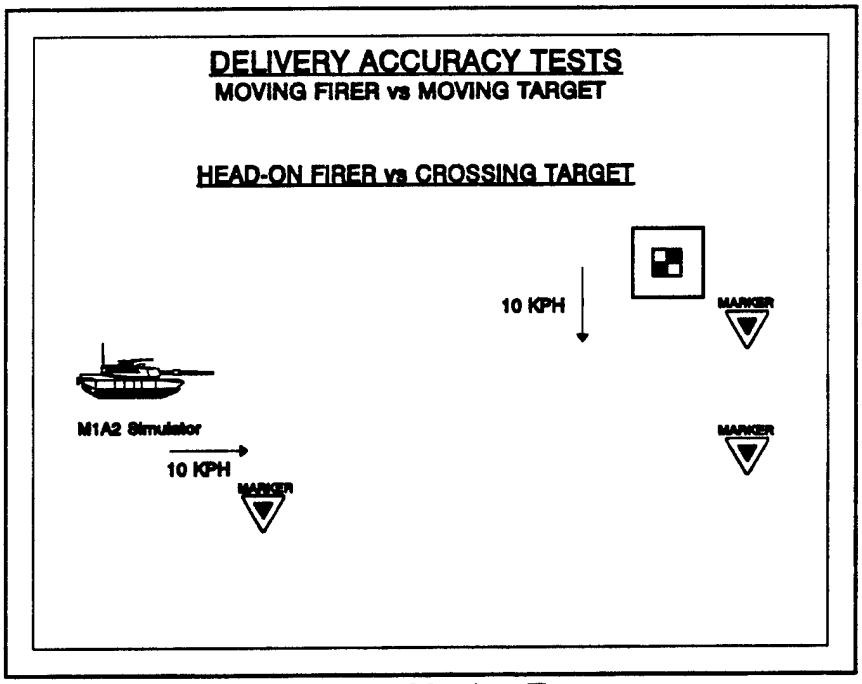

Figure 11 Moving Firer vs Moving Target

meters. During this test, the soldiers fired 10-20 sabot rounds in one replication and 10-20 HEAT rounds in the next replication.

The moving firer versus stationary targets tests are shown in Figure 10. The stationary targets and markers are played back in a logger file. The head-on firer approaches one of the target boards. As the simulator passes each marker, the gunner fires 2 sabot and 2 HEAT rounds. For the next replication, the simulator is repositioned to its previous location, drives toward the other target-board, and fires while passing the markers. This is repeated until sufficient replications are achieved.

The crossing firer versus stationary target, Figure 10, consists of two logger play back logger files. One logger file locates the target at 1000 meters range and the other logger file places the target at 1500 meters range. As in all cases, the simulator is positioned by the simulator console. In this test, the gunner slews the turret on target. As the simulator passes the first marker two sabot and two HEAT rounds are fired. Each logger file is replicated a number times.

The last delivery accuracy test examines the moving firer versus moving target scenario, as shown in Figure 11. One logger file was developed with markers and the target-board located at 1500 meters range. During the test, as the simulator passes the marker and the target is in between the markers, then the gunner fires two sabot rounds. Again, the logger file is replicated.

Logger files provide the ability to control a vehicle's path and speed, through specifying location points on the path and the vehicle's velocity and acceleration. Logger files also allow a target to sustain multiple hits without any damage or kill effect, which would interfere in a delivery accuracy test. Furthermore, the target's height above terrain can be held constant in a logger file, which is another desirable condition for delivery accuracy tests. MODSAF, on the other hand, does not permit the ability to input exact points on a path and to specify a particular velocity and acceleration between the points. MODSAF also forces vehicles to follow the terrain and to negotiate around unpassable terrain or obstacles.

4.4 DIS Analytical Tools (DISAT)

During VV&A testing, the simulator sends and receives standard DIS PDU's in addition to sending the specialized VV&A PDU's. All these PDU's are captured on a Datalogger. The Datalogged PDU's form the primary basic raw data which can be used in calculations to produce measures of effectiveness, performance, and behaviors. The DIS Analytical Tools (DISAT), developed by A2 ATD, consist of a number of computer routines which calculate certain measures of merit based on the Datalogged PDU's. A subset of the DISAT tool box was designed to support simulator VV&A.

The majority of the simulator VV&A DISAT routines simply extract the VV&A PDU's (actually Action Response PDU's), format the VV&A PDU fields and output the data. The VV&A PDU's contain the simulator's calculations. In addition to the VV&A PDU's, the DISAT uses other Standard DIS PDU's to determine critical data necessary to supplement and to validate the calculations that are contained in the VV&A PDU's. The Standard DIS PDU's typically used are the Entity State, Fire and Detonate. The DISAT formats and outputs applicable fields such as the simulator's location and heading, the target location and heading, round detonation location, etc. The DISAT also calculates the range to target, attack angle of rounds, velocity versus time and acceleration versus time.

4.5 Simulation Manager (SIMAN)

The Simulation Manager, developed by STRICOM, issues and receives Simulation Management PDU's in order to initiate and control an exercise. PDU's that SIMAN sends are: Set Data, Data Query, Action Request, Create Entity, Remove Entity, Start/Resume, and Stop/Freeze. PDU's that SIMAN receives are: Event Report, Data, Action Response, and Acknowledge. All these PDU's are not supported in the current SIMAN release. However, some of the SIMAN PDU's were used to support the M1A2 simulator VV&A, and as the SIMAN matures this tool may be more useful in facilitating the conduct of simulator VV&A.

The SIMAN issues Set Data PDU's that can be used to set the fuel level in a simulator. This Set Data was used in the M1A2 simulator VV&A to zero the fuel levels in the left and right fuel tanks, and to set the fuel level in the rear tank to a specific number of liters. Subsequently, a fuel consumption test could be executed with a known initial quantity of fuel. Without this tool either 1) the simulator code would have to be changed or 2) the fuel consumption test must be run with full rear and full auxiliary fuel cells requiring an inordinate amount of time to starve the simulator of fuel.

Another PDU that the SIMAN issues is the Data Query PDU. This PDU can be used to specify the periodic time interval that the simulator issues the Target Acquisition and Tracking VV&A PDU. The simulator is hard-coded to issue the Target Acquisition and Tracking PDU once every 2 seconds, currently; however, to support tracking analysis for delivery accuracy VV&A the data must be captured at a minimum frequency of 12 hertz. The Data Query PDU was used during the M1A2 VV&A to set the frequency of the Target Acquisition and Tracking PDU.

The Data Query PDU can also be used to change the Dead Reckoning parameters. This was not used for the M1A2 simulator VV&A; however, it could be used to support mobility/automotive performance tests. Appropriately changing the Dead Reckoning parameters will force Entity State PDU's to be generated more often. Entity State PDU's are the primary data source for mobility test data such as distance traveled, velocity, acceleration, etc. Frequent data points allow a better estimate of actual simulator performance.

SIMAN was only used for a few functions during the M1A2 VV&A; however, these functions were critical to obtaining quality data, reducing test time and avoiding temporarily changing hard-coded simulator default values.

5 . SUMMARY

The VV&A tools will continue to evolve and mature. In addition, other tools will be developed. For example, play-back logger files for vulnerability tests would significantly reduce vulnerability test set-up and execution. The VV&A tools for simulators, to-date, have been developed for the M1A2 simulator; however the tools are sufficiently general for other weapon simulators to use or adapt.

REFERENCES

1. USAMSAA, Memorandum, Subject: Anti-Armor Advanced Technology Demonstration (A2 ATD) Technology Demonstration Plan (TDP), 29 Apr 1993.

2. "Anti-Armor Advanced Technology Demonstration (A2 ATD) Line-of-Sight Anti-tank (LOSAT) Simulator Verification, Validation and Accreditation Plan", Draft AMSAA Report, Feb 1994.

3. "Anti-Armor Advanced Technology Demonstration (A2 ATD) M1A2 Simulator Verification, Validation and Accreditation Plan", Draft AMSAA Report, Dec 1993.

4. Discussions between Irene Johnson (AMSAA) and Paul Monday (Loral - Advanced Distributed Simulation), Subject: Logger Files and DISAT, Aug 1994.

5. Discussions between Irene Johnson (AMSAA) and Tung Duong (Loral - Advanced Distributed Simulation), Subject: VVATT, Feb 1995.

6. "Interface Requirements Specification/Design Document for M1A2 Simulator System", Orion Advanced Simulation and Intel Systems Inc, OASIS-LR-9301-05-02, Mar 1994.

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APPENDIX A - VVATT SAMPLE

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```
                          A2ATD TARGET ACQUISITION TEST
                              ACTIVITY RECORD

Name: John Doe
SSN:  111-22-3456
Date: 11/21/94
Trial Number: 1
Trial Type: FOR

CONDITION #1
------------

OWN VEH:
   Id: M1A2 (Tank)
   UTM coord: (Zone = 14, N = 3458050.000, E = 608017.000, A = 269.000)
   GCC coord: (X = -746906.920, Y = -5406307.144, Z = 3290077.019)
   FOV: NFOV (0),  Sensor: DVO (0)

BOARDS:
   Board #1 Id: TB_2line (25)
      UTM coord: (Zone = 14, N = 3458050.000, E = 608017.000, A = 2000.000)
      GCC coord: (X = -747109.438, Y = -5407771.022, Z = 3290975.102)
      GCC range: 1731.000  (Band = 'SHORT')
   Board #2 Id: TB_4line (26)
      UTM coord: (Zone = 14, N = 3458050.000, E = 608017.000, A = 4005.000)
      GCC coord: (X = -747344.003, Y = -5409470.933, Z = 3292015.343)
      GCC range: 3736.000  (Band = 'LONG')

ACTUAL TGT:
   Recognition: Tank (Hull Defilade)
   Identification: M1A2
   UTM coord: (Zone = 14, N = 3458050.000, E = 608017.000, A = 2000.000)
   GCC coord: (X = -747109.438, Y = -5407771.022, Z = 3290975.102)
   GCC range: 1731.000  (Band = 'SHORT')

PERCEIVED TGT:
   Identification: M1A2 (Tank)
   Acquisition Time:  0.20

SCORING:
   Detection, Recognition, and Identification

CONDITION #2
------------

OWN VEH:
   Id: M2A3 (APC)
   UTM coord: (Zone = 14, N = 3358050.000, E = 506800.000, A = 169.000)
   GCC coord: (X = -855035.469, Y = -5441758.065, Z = 3204572.674)
   FOV: WFOV (1),  Sensor: FLIR (1)

BOARDS:
   Board #1 Id: TB_4line (26)
      UTM coord: (Zone = 14, N = 3358050.000, E = 506800.000, A = 5769.000)
      GCC coord: (X = -855785.486, Y = -5446531.755, Z = 3207402.550)
      GCC range: 5600.000  (Band = 'VERY LONG')

ACTUAL TGT:
   NULL Target

PERCEIVED TGT:
   NULL Target
   Acquisition Time:  0.30

SCORING:
   NULL Target Detected Correctly

CONDITION #3
```



```
------------

OWN VEH:
   Id: MLOS (Truck)
   UTM coord: (Zone = 14, N = 3458050.000, E = 588017.000, A = 269.000)
   GCC coord: (X = -766705.833, Y = -5403437.243, Z = 3290236.659)
   FOV: NFOV (2),  Sensor: OTH (2)

BOARDS:
   Board #1 Id: TB_8line (27)
      UTM coord: (Zone = 14, N = 3458050.000, E = 588017.000, A = 3970.000)
      GCC coord: (X = -767150.290, Y = -5406569.729, Z = 3292156.717)
      GCC range: 3701.000  (Band = 'LONG')
   Board #2 Id: TB_2line (25)
      UTM coord: (Zone = 14, N = 3458050.000, E = 588017.000, A = 5769.000)
      GCC coord: (X = -767366.335, Y = -5408092.383, Z = 3293090.825)
      GCC range: 5500.000  (Band = 'VERY LONG')

ACTUAL TGT:
   NULL Target

PERCEIVED TGT:
   Identification: LOSAT (Tank)
   Acquisition Time:  0.20

SCORING:
   False Target Detected

CONDITION #4
------------

OWN VEH:
   Id: LOSAT (Tank)
   UTM coord: (Zone = 14, N = 347250.000, E = 607900.000, A = 318.000)
   GCC coord: (X = -889568.516, Y = -6306505.215, Z = 367182.279)
   FOV: ZOOM (3),  Sensor: TV (3)

BOARDS:
   No Board

ACTUAL TGT:
   Recognition: APC (Hull Defilade)
   Identification: M2A3
   UTM coord: (Zone = 0, N = 0.000, E = 0.000, A = 0.000)
   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
   GCC range: 8977669.709  (Band = 'Invalid > VERY LONG')

PERCEIVED TGT:
   Identification: BTR-60 (APC)
   Acquisition Time:  0.20

SCORING:
   Detection and Recognition

CONDITION #5
------------

OWN VEH:
   Id: AH-64 (R/W)
   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, A = 318.000)
   GCC coord: (X = -747128.643, Y = -5406962.996, Z = 3289050.780)
   FOV: UNITY (4),  Sensor: I2 (4)

BOARDS:
   Board #1 Id: TB_2x1 (29)
      UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, A = 4018.000)
      GCC coord: (X = -747561.632, Y = -5410096.657, Z = 3290969.816)
      GCC range: 3700.000  (Band = 'LONG')
```

```
143|ACTUAL TGT:
144|    Recognition: Truck (Full Defilade)
145|    Identification: HLOS
146|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 2180.000)
147|    GCC coord: (X = -767346.342, Y = -5408539.990, Z = 3290016.521)
148|    GCC range: 1862.000  (Band = 'Invalid < MEDIUM')
149|
150|PERCEIVED TGT:
151|    Identification: T-62 (Tank)
152|    Acquisition Time:  0.30
153|
154|SCORING:
155|    Detection
156|
157|
158|CONDITION #6
159|-------------
160|
161|OWN VEH:
162|    Id: HUNTER (Truck)
163|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
164|    GCC coord: (X = -767128.443, Y = -5406962.996, Z = 3289050.780)
165|    FOV: NIR ZOOM (5),  Sensor: GUNNER FLIR (5)
166|
167|BOARDS:
168|    Board #1 Id: TB_6line (26)
169|       UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 5818.000)
170|       GCC coord: (X = -767772.075, Y = -5411621.141, Z = 3291903.398)
171|       GCC range: 5500.000  (Band = 'VERY LONG')
172|
173|ACTUAL TGT:
174|    Recognition: Tank (Fully Exposed)
175|    Identification: LOSAT
176|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 2780.000)
177|    GCC coord: (X = -767416.556, Y = -5409068.151, Z = 3290327.716)
178|    GCC range: 2462.000  (Band = 'MEDIUM')
179|
180|PERCEIVED TGT:
181|    Identification: T-80 (Tank)
182|    Acquisition Time:  0.00
183|
184|SCORING:
185|    Detection and Recognition
186|
187|
188|CONDITION #7
189|-------------
190|
191|OWN VEH:
192|    Id: JAVELIN (Others)
193|    UTM coord: (Zone = 14, N = 3472250.000, E = 608017.000, Z = 318.000)
194|    GCC coord: (X = -889452.728, Y = -6306521.567, Z = 3471182.170)
195|    FOV: MAX ZOOM (6),  Sensor: DVO (0)
196|
197|BOARDS:
198|    Board #1 Id: TB_2x3 (31)
199|       UTM coord: (Zone = 14, N = 3472250.000, E = 608017.000, Z = 4018.000)
200|       GCC coord: (X = -889968.675, Y = -6310179.803, Z = 3473384.918)
201|       GCC range: 3700.000  (Band = 'LONG')
202|
203|ACTUAL TGT:
204|    Recognition: APC (Full Defilade)
205|    Identification: BMP-2
206|    UTM coord: (Zone = 14, N = 3472250.000, E = 608017.000, Z = 2790.000)
207|    GCC coord: (X = -889797.436, Y = -6308965.666, Z = 3473317.628)
208|    GCC range: 2472.000  (Band = 'MEDIUM')
209|
210|PERCEIVED TGT:
211|    Identification: M2A3 (APC)
212|    Acquisition Time:  0.10
213|
```



```
214|SCORING:
215|    Detection and Recognition
216|
217|
218|CONDITION #8
219|-------------
220|
221|OWN VEH:
222|    Id: M1A2 (Tank)
223|    UTM coord: (Zone = 14, N = 3472250.000, E = 607900.000, Z = 318.000)
224|    GCC coord: (X = -889568.616, Y = -6306505.215, Z = 3471182.279)
225|    FOV: NFOV (0),  Sensor: GTW (2)
226|
227|BOARDS:
228|    Board #1 Id: TB_6line (30)
229|       UTM coord: (Zone = 14, N = 3472250.000, E = 607900.000, Z = 5900.000)
230|       GCC coord: (X = -890347.099, Y = -6312024.198, Z = 3471488.158)
231|       GCC range: 5582.000  (Band = 'VERY LONG')
232|
233|ACTUAL TGT:
234|    Recognition: Tank (Fully Exposed)
235|    Identification: T-62
236|    UTM coord: (Zone = 14, N = 3472250.000, E = 607900.000, Z = 4000.000)
237|    GCC coord: (X = -890082.119, Y = -6310165.665, Z = 3471384.040)
238|    GCC range: 3682.000  (Band = 'LONG')
239|
240|PERCEIVED TGT:
241|    Identification: T-62 (Tank)
242|    Acquisition Time:  0.30
243|
244|SCORING:
245|    Detection, Recognition, and Identification
246|
247|
248|CONDITION #9
249|-------------
250|
251|OWN VEH:
252|    Id: M2A3 (APC)
253|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
254|    GCC coord: (X = -767128.443, Y = -5406962.996, Z = 3289050.780)
255|    FOV: NFOV (0),  Sensor: DVO (0)
256|
257|BOARDS:
258|    Board #1 Id: TB_6line (26)
259|       UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 2818.000)
260|       GCC coord: (X = -767421.003, Y = -5409080.335, Z = 3290367.625)
261|       GCC range: 2500.000  (Band = 'MEDIUM')
262|
263|ACTUAL TGT:
264|    Recognition: Tank (Full Defilade)
265|    Identification: T-72
266|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 6000.000)
267|    GCC coord: (X = -767559.325, Y = -5410081.412, Z = 3290960.478)
268|    GCC range: 3682.000  (Band = 'LONG')
269|
270|PERCEIVED TGT:
271|    Identification: BTR-60 (APC)
272|    Acquisition Time:  0.12
273|
274|SCORING:
275|    Detection
276|
277|
278|CONDITION #10
279|-------------
280|
281|OWN VEH:
282|    Id: HLOS (Truck)
283|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
284|    GCC coord: (X = -767128.443, Y = -5406962.996, Z = 3289050.780)
```

```
285|   FOV: WFOV (1),  Sensor: FLIR (1)
286|
287|BOARDS:
288|   Board #1 Id: TB_Sline (27)
289|      UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 2000.000)
290|      GCC coord: (X = -747325.277, Y = -5408387.541, Z = 3289923.163)
291|      GCC range: 1682.000  (Band = 'SHORT')
292|
293|ACTUAL TGT:
294|   Recognition: Tank (Hull Defilade)
295|   Identification: T-80
296|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 4000.000)
297|   GCC coord: (X = -747559.325, Y = -5410081.612, Z = 3290960.478)
298|   GCC range: 3682.000  (Band = 'LONG')
299|
300|PERCEIVED TGT:
301|   Identification: T-72 (Tank)
302|   Acquisition Time:  0.20
303|
304|SCORING:
305|   Detection and Recognition
306|
307|
308|CONDITION #11
309|-------------
310|
311|OWN VEH:
312|   Id: LOSAT (Tank)
313|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 310.000)
314|   GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
315|   FOV: NFOV (0),  Sensor: DVO (0)
316|
317|BOARDS:
318|   No Board
319|
320|ACTUAL TGT:
321|   Recognition: Truck (Fully Exposed)
322|   Identification: BDMV
323|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 5900.000)
324|   GCC coord: (X = -747781.671, Y = -5411690.590, Z = 3291945.928)
325|   GCC range: 5582.000  (Band = 'VERY LONG')
326|
327|PERCEIVED TGT:
328|   Identification: BDMV (Truck)
329|   Acquisition Time:  0.20
330|
331|SCORING:
332|   Detection, Recognition, and Identification
333|
334|
335|CONDITION #12
336|-------------
337|
338|OWN VEH:
339|   Id: AH-64 (R/W)
340|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 310.000)
341|   GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
342|   FOV: NFOV (0),  Sensor: DVO (0)
343|
344|BOARDS:
345|   No Board
346|
347|ACTUAL TGT:
348|   Recognition: Truck (Hull Defilade)
349|   Identification: HEMTT
350|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 5850.000)
351|   GCC coord: (X = -747775.820, Y = -5411648.243, Z = 3291919.995)
352|   GCC range: 5532.000  (Band = 'VERY LONG')
353|
354|PERCEIVED TGT:
355|   Identification: ELOS (Truck)
```



```
356|   Acquisition Time:  0.20
357|
358|SCORING:
359|   Detection and Recognition
360|
361|
362|CONDITION #13
363|-------------
364|
365|OWN VEH:
366|   Id: HUNTER (Truck)
367|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 310.000)
368|   GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
369|   FOV: NFOV (0),  Sensor: DVO (0)
370|
371|BOARDS:
372|   No Board
373|
374|ACTUAL TGT:
375|   Recognition: APC (Fully Exposed)
376|   Identification: BTR-60
377|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 4000.000)
378|   GCC coord: (X = -747559.325, Y = -5410081.612, Z = 3290960.478)
379|   GCC range: 3682.000  (Band = 'LONG')
380|
381|PERCEIVED TGT:
382|   Identification: M2A3 (APC)
383|   Acquisition Time:  0.20
384|
385|SCORING:
386|   Detection and Recognition
387|
388|
389|CONDITION #14
390|-------------
391|
392|OWN VEH:
393|   Id: JAVELIN (Others)
394|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 310.000)
395|   GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
396|   FOV: NFOV (0),  Sensor: DVO (0)
397|
398|BOARDS:
399|   No Board
400|
401|ACTUAL TGT:
402|   Recognition: Truck (Fully Exposed)
403|   Identification: SA-21
404|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 2900.000)
405|   GCC coord: (X = -747430.599, Y = -5409169.783, Z = 3290389.955)
406|   GCC range: 2582.000  (Band = 'MEDIUM')
407|
408|PERCEIVED TGT:
409|   Identification: HEMTT (Truck)
410|   Acquisition Time:  0.20
411|
412|SCORING:
413|   Detection and Recognition
414|
415|
416|CONDITION #15
417|-------------
418|
419|OWN VEH:
420|   Id: M1A2 (Tank)
421|   UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, S = 310.000)
422|   GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
423|   FOV: NFOV (0),  Sensor: DVO (0)
424|
425|BOARDS:
426|   No Board
```

```
427|
428|ACTUAL TGT:
429|    Recognition: Truck (Fully Exposed)
430|    Identification: GAZ-66
431|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 5900.000)
432|    GCC coord: (X = -747781.671, Y = -5411690.590, Z = 3291945.928)
433|    GCC range: 5582.000  (Band = 'VERY LONG')
434|
435|PERCEIVED TGT:
436|    Identification: GAZ-66 (Truck)
437|    Acquisition Time:  0.20
438|
439|SCORING:
440|    Detection, Recognition, and Identification
441|
442|
443|CONDITION #16
444|-------------
445|
446|OWN VEH:
447|    Id: M1A2 (Tank)
448|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
449|    GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
450|    FOV: NFOV (0),  Sensor: DVO (0)
451|
452|BOARDS:
453|    No Board
454|
455|ACTUAL TGT:
456|    Recognition: F/W (Fully Exposed)
457|    Identification: F-16
458|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 2900.000)
459|    GCC coord: (X = -747430.599, Y = -5409149.783, Z = 3290389.955)
460|    GCC range: 2582.000  (Band = 'MEDIUM')
461|
462|PERCEIVED TGT:
463|    Identification: F-15 (F/W)
464|    Acquisition Time:  0.20
465|
466|SCORING:
467|    Detection and Recognition
468|
469|
470|CONDITION #17
471|-------------
472|
473|OWN VEH:
474|    Id: M1A2 (Tank)
475|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
476|    GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
477|    FOV: NFOV (0),  Sensor: DVO (0)
478|
479|BOARDS:
480|    No Board
481|
482|ACTUAL TGT:
483|    Recognition: F/W (Fully Exposed)
484|    Identification: F-15
485|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 2000.000)
486|    GCC coord: (X = -747325.277, Y = -5408387.541, Z = 3289923.163)
487|    GCC range: 1682.000  (Band = 'SHORT')
488|
489|PERCEIVED TGT:
490|    Identification: F-15 (F/W)
491|    Acquisition Time:  0.20
492|
493|SCORING:
494|    Detection, Recognition, and Identification
495|
496|
497|CONDITION #18
```



```
498|-------------
499|
500|OWN VEH:
501|    Id: M1A2 (Tank)
502|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
503|    GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
504|    FOV: NFOV (0),  Sensor: DVO (0)
505|
506|BOARDS:
507|    No Board
508|
509|ACTUAL TGT:
510|    Recognition: F/W (Hull-Defilade)
511|    Identification: F/A-18
512|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 5900.000)
513|    GCC coord: (X = -747781.671, Y = -5411690.590, Z = 3291945.928)
514|    GCC range: 5582.000  (Band = 'VERY LONG')
515|
516|PERCEIVED TGT:
517|    Identification: F/A-18 (F/W)
518|    Acquisition Time:  0.20
519|
520|SCORING:
521|    Detection, Recognition, and Identification
522|
523|
524|CONDITION #19
525|-------------
526|
527|OWN VEH:
528|    Id: M1A2 (Tank)
529|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
530|    GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
531|    FOV: NFOV (0),  Sensor: DVO (0)
532|
533|BOARDS:
534|    No Board
535|
536|ACTUAL TGT:
537|    Recognition: F/W (Fully Exposed)
538|    Identification: F/A-18
539|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 2900.000)
540|    GCC coord: (X = -747430.599, Y = -5409149.783, Z = 3290389.955)
541|    GCC range: 2582.000  (Band = 'MEDIUM')
542|
543|PERCEIVED TGT:
544|    Identification: F/A-18 (F/W)
545|    Acquisition Time:  0.20
546|
547|SCORING:
548|    Detection, Recognition, and Identification
549|
550|
551|CONDITION #20
552|-------------
553|
554|OWN VEH:
555|    Id: M2A3 (APC)
556|    UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 318.000)
557|    GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
558|    FOV: MAX ZOOM (6),  Sensor: SEEKER FPA-IR (5)
559|
560|BOARDS:
561|    Board #1 Id: TB_2line (25)
562|       UTM coord: (Zone = 14, N = 3456819.000, E = 607900.000, Z = 2000.000)
563|       GCC coord: (X = -747325.277, Y = -5408387.541, Z = 3289923.163)
564|       GCC range: 1682.000  (Band = 'SHORT')
565|    Board #2 Id: TB_4line (26)
566|       UTM coord: (Zone = 14, N = 3456820.000, E = 607908.000, Z = 2001.000)
567|       GCC coord: (X = -747317.390, Y = -5408389.016, Z = 3289926.467)
568|       GCC range: 1683.019  (Band = 'SHORT')
```

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569|
570|ACTUAL TGT:
571|    Recognition: R/W (Null Defilade)
572|    Identification: SU-25
573|    UTM coord: (Zone = 14, N = 3656819.000, E = 607900.000, Z = 4000.000)
574|    GCC coord: (X = -747559.325, Y = -5410081.412, Z = 3290960.478)
575|    GCC range: 3682.000  (Band = 'LONG')
576|
577|PERCEIVED TGT:
578|    Identification: SU-25 (F/W)
579|    Acquisition Time:  0.20
580|
581|SCORING:
582|    Detection, Recognition, and Identification
583|
584|
585|CONDITION #21
586|-------------
587|
588|OWN VEH:
589|    Id: M2A3 (APC)
590|    UTM coord: (Zone = 14, N = 3656819.000, E = 607900.000, Z = 318.000)
591|    GCC coord: (X = -747128.443, Y = -5406962.996, Z = 3289050.780)
592|    FOV: MAX ZOOM (6),  Sensor: SEEKER FPA-IR (5)
593|
594|BOARDS:
595|    Board #1 Id: TB_4line (26)
596|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
597|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
598|       GCC range: 8990659.718  (Band = 'Invalid > VERY LONG')
599|    Board #2 Id: TB_4line (26)
600|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
601|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
602|       GCC range: 8990659.718  (Band = 'Invalid > VERY LONG')
603|
604|ACTUAL TGT:
605|    Recognition: R/W (Null Defilade)
606|    Identification: SU-29
607|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
608|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
609|    GCC range: 8990659.718  (Band = 'Invalid > VERY LONG')
610|
611|PERCEIVED TGT:
612|    Identification: SU-29 (F/W)
613|    Acquisition Time:  0.20
614|
615|SCORING:
616|    Detection, Recognition, and Identification
617|
618|
619|CONDITION #22
620|-------------
621|
622|OWN VEH:
623|    Id: NULL_TGT (Others)
624|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
625|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
626|    FOV: NFOV (0),  Sensor: DVO (0)
627|
628|BOARDS:
629|    Board #1 Id: TB_4line (26)
630|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
631|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
632|       GCC range: 0.000  (Band = 'Invalid < SHORT')
633|    Board #2 Id: TB_4line (26)
634|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
635|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
636|       GCC range: 0.000  (Band = 'Invalid < SHORT')
637|
638|ACTUAL TGT:
639|    Recognition: R/W (Null Defilade)
```



```
640|    Identification: OH-58
641|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
642|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
643|    GCC range: 0.000  (Band = 'Invalid < SHORT')
644|
645|PERCEIVED TGT:
646|    Identification: OH-58 (R/W)
647|    Acquisition Time:  0.05
648|
649|SCORING:
650|    Detection, Recognition, and Identification
651|
652|
653|CONDITION #23
654|-------------
655|
656|OWN VEH:
657|    Id: NULL_TGT (Others)
658|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
659|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
660|    FOV: NFOV (0),  Sensor: DVO (0)
661|
662|BOARDS:
663|    Board #1 Id: TB_4line (26)
664|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
665|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
666|       GCC range: 0.000  (Band = 'Invalid < SHORT')
667|    Board #2 Id: TB_4line (26)
668|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
669|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
670|       GCC range: 0.000  (Band = 'Invalid < SHORT')
671|
672|ACTUAL TGT:
673|    Recognition: R/W (Null Defilade)
674|    Identification: AH-64
675|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
676|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
677|    GCC range: 0.000  (Band = 'Invalid < SHORT')
678|
679|PERCEIVED TGT:
680|    Identification: AH-64 (R/W)
681|    Acquisition Time:  0.20
682|
683|SCORING:
684|    Detection, Recognition, and Identification
685|
686|
687|CONDITION #24
688|-------------
689|
690|OWN VEH:
691|    Id: NULL_TGT (Others)
692|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
693|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
694|    FOV: NFOV (0),  Sensor: DVO (0)
695|
696|BOARDS:
697|    Board #1 Id: TB_4line (26)
698|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
699|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
700|       GCC range: 0.000  (Band = 'Invalid < SHORT')
701|    Board #2 Id: TB_4line (26)
702|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
703|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
704|       GCC range: 0.000  (Band = 'Invalid < SHORT')
705|
706|ACTUAL TGT:
707|    Recognition: R/W (Null Defilade)
708|    Identification: AH-1
709|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
710|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
```

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711|   GCC range: 0.000  (Band = 'Invalid < SHORT')
712|
713|PERCEIVED TGT:
714|   Identification: AH-1 (R/W)
715|   Acquisition Time:  0.30
716|
717|SCORING:
718|   Detection, Recognition, and Identification
719|
720|
721|CONDITION #25
722|-------------
723|
724|OWN VEH:
725|   Id: NULL_TGT (Others)
726|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
727|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
728|   FOV: NFOV (0),  Sensor: DVO (0)
729|
730|BOARDS:
731|   Board #1 Id: TB_4line (26)
732|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
733|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
734|      GCC range: 0.000  (Band = 'Invalid < SHORT')
735|   Board #2 Id: TB_4line (26)
736|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
737|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
738|      GCC range: 0.000  (Band = 'Invalid < SHORT')
739|
740|ACTUAL TGT:
741|   Recognition: R/W (Hull Defilade)
742|   Identification: MI_8
743|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
744|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
745|   GCC range: 0.000  (Band = 'Invalid < SHORT')
746|
747|PERCEIVED TGT:
748|   Identification: MI_24 (R/W)
749|   Acquisition Time:  0.20
750|
751|SCORING:
752|   Detection and Recognition
753|
754|
755|CONDITION #26
756|-------------
757|
758|OWN VEH:
759|   Id: NULL_TGT (Others)
760|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
761|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
762|   FOV: NFOV (0),  Sensor: DVO (0)
763|
764|BOARDS:
765|   Board #1 Id: TB_4line (26)
766|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
767|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
768|      GCC range: 0.000  (Band = 'Invalid < SHORT')
769|   Board #2 Id: TB_4line (26)
770|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
771|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
772|      GCC range: 0.000  (Band = 'Invalid < SHORT')
773|
774|ACTUAL TGT:
775|   Recognition: R/W (Hull Defilade)
776|   Identification: MI_24
777|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
778|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
779|   GCC range: 0.000  (Band = 'Invalid < SHORT')
780|
781|PERCEIVED TGT:
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782|   Identification: MI_24 (R/W)
783|   Acquisition Time:  0.20
784|
785|SCORING:
786|   Detection, Recognition, and Identification
787|
788|
789|CONDITION #27
790|-------------
791|
792|OWN VEH:
793|   Id: NULL_TGT (Others)
794|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
795|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
796|   FOV: NFOV (0),  Sensor: DVO (0)
797|
798|BOARDS:
799|   Board #1 Id: TB_4line (26)
800|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
801|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
802|      GCC range: 0.000  (Band = 'Invalid < SHORT')
803|   Board #2 Id: TB_4line (26)
804|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
805|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
806|      GCC range: 0.000  (Band = 'Invalid < SHORT')
807|
808|ACTUAL TGT:
809|   Recognition: R/W (Hull Defilade)
810|   Identification: MI-28
811|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
812|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
813|   GCC range: 0.000  (Band = 'Invalid < SHORT')
814|
815|PERCEIVED TGT:
816|   Identification: MI-28 (R/W)
817|   Acquisition Time:  0.20
818|
819|SCORING:
820|   Detection, Recognition, and Identification
821|
822|
823|CONDITION #28
824|-------------
825|
826|OWN VEH:
827|   Id: NULL_TGT (Others)
828|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
829|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
830|   FOV: NFOV (0),  Sensor: DVO (0)
831|
832|BOARDS:
833|   Board #1 Id: TB_4line (26)
834|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
835|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
836|      GCC range: 0.000  (Band = 'Invalid < SHORT')
837|   Board #2 Id: TB_4line (26)
838|      UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
839|      GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
840|      GCC range: 0.000  (Band = 'Invalid < SHORT')
841|
842|ACTUAL TGT:
843|   Recognition: R/W (Hull Defilade)
844|   Identification: SAM-66
845|   UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
846|   GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
847|   GCC range: 0.000  (Band = 'Invalid < SHORT')
848|
849|PERCEIVED TGT:
850|   Recognition: R/W
851|   Acquisition Time:  0.30
852|
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853|SCORING:
854|    Detection and Recognition
855|
856|
857|CONDITION #29
858|-------------
859|
860|OWN VEH:
861|    Id: NULL_TGT (Others)
862|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
863|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
864|    FOV: NFOV (0),  Sensor: DVO (0)
865|
866|BOARDS:
867|    Board #1 Id: TB_4line (26)
868|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
869|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
870|       GCC range: 0.000  (Band = 'Invalid < SHORT')
871|    Board #2 Id: TB_4line (26)
872|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
873|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
874|       GCC range: 0.000  (Band = 'Invalid < SHORT')
875|
876|ACTUAL TGT:
877|    Recognition: SP_Art (Hull Defilade)
878|    Identification: HOW_M109A6
879|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
880|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
881|    GCC range: 0.000  (Band = 'Invalid < SHORT')
882|
883|PERCEIVED TGT:
884|    Identification: HOW_M109A6 (SP_Art)
885|    Acquisition Time:  0.20
886|
887|SCORING:
888|    Detection, Recognition, and Identification
889|
890|
891|CONDITION #30
892|-------------
893|
894|OWN VEH:
895|    Id: NULL_TGT (Others)
896|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
897|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
898|    FOV: NFOV (0),  Sensor: DVO (0)
899|
900|BOARDS:
901|    Board #1 Id: TB_4line (26)
902|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
903|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
904|       GCC range: 0.000  (Band = 'Invalid < SHORT')
905|    Board #2 Id: TB_4line (26)
906|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
907|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
908|       GCC range: 0.000  (Band = 'Invalid < SHORT')
909|
910|ACTUAL TGT:
911|    Recognition: SP_Art (Hull Defilade)
912|    Identification: HOW_2S19
913|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
914|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
915|    GCC range: 0.000  (Band = 'Invalid < SHORT')
916|
917|PERCEIVED TGT:
918|    Identification: HOW_2S19 (SP_Art)
919|    Acquisition Time:  0.20
920|
921|SCORING:
922|    Detection, Recognition, and Identification
923|
```



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924|
925|CONDITION #31
926|-------------
927|
928|OWN VEH:
929|    Id: NULL_TGT (Others)
930|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
931|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
932|    FOV: NFOV (0),  Sensor: DVO (0)
933|
934|BOARDS:
935|    Board #1 Id: TB_4line (26)
936|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
937|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
938|       GCC range: 0.000  (Band = 'Invalid < SHORT')
939|    Board #2 Id: TB_4line (26)
940|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
941|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
942|       GCC range: 0.000  (Band = 'Invalid < SHORT')
943|
944|ACTUAL TGT:
945|    Recognition: SP_Art (Hull Defilade)
946|    Identification: MORTAR_M106
947|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
948|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
949|    GCC range: 0.000  (Band = 'Invalid < SHORT')
950|
951|PERCEIVED TGT:
952|    Identification: MORTAR_M106 (SP_Art)
953|    Acquisition Time:  0.20
954|
955|SCORING:
956|    Detection, Recognition, and Identification
957|
958|
959|CONDITION #32
960|-------------
961|
962|OWN VEH:
963|    Id: NULL_TGT (Others)
964|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
965|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
966|    FOV: NFOV (0),  Sensor: DVO (0)
967|
968|BOARDS:
969|    Board #1 Id: TB_4line (26)
970|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
971|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
972|       GCC range: 0.000  (Band = 'Invalid < SHORT')
973|    Board #2 Id: TB_4line (26)
974|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
975|       GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
976|       GCC range: 0.000  (Band = 'Invalid < SHORT')
977|
978|ACTUAL TGT:
979|    Recognition: SP_Art (Hull Defilade)
980|    Identification: MORTAR_2S12
981|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
982|    GCC coord: (X = -6323736.584, Y = 831271.616, Z = 0.000)
983|    GCC range: 0.000  (Band = 'Invalid < SHORT')
984|
985|PERCEIVED TGT:
986|    Recognition: R/W
987|    Acquisition Time:  0.20
988|
989|SCORING:
990|    Detection
991|
992|
993|CONDITION #33
994|-------------
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 995|
 996|OWN VEH:
 997|    Id: NULL_TGT (Others)
 998|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
 999|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1000|    FOV: NFOV (0),  Sensor: DVO (0)
1001|
1002|BOARDS:
1003|    Board #1 Id: TB_4line (26)
1004|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1005|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1006|       GCC range: 0.000  (Band = 'Invalid < SHORT')
1007|    Board #2 Id: TB_4line (26)
1008|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1009|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1010|       GCC range: 0.000  (Band = 'Invalid < SHORT')
1011|
1012|ACTUAL TGT:
1013|    NULL Target
1014|
1015|PERCEIVED TGT:
1016|    Identification: M2A1 (APC)
1017|    Acquisition Time:  0.20
1018|
1019|SCORING:
1020|    False Target Detected
1021|
1022|
1023|CONDITION #14
1024|-------------
1025|
 026|OWN VEH:
 027|    Id: NULL_TGT (Others)
1028|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1029|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1030|    FOV: NFOV (0),  Sensor: DVO (0)
1031|
1032|BOARDS:
1033|    Board #1 Id: TB_4line (26)
1034|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1035|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1036|       GCC range: 0.000  (Band = 'Invalid < SHORT')
1037|    Board #2 Id: TB_4line (26)
1038|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1039|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1040|       GCC range: 0.000  (Band = 'Invalid < SHORT')
1041|
1042|ACTUAL TGT:
1043|    Recognition: Tank (Hull Defilade)
1044|    Identification: M1A2
1045|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1046|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1047|    GCC range: 0.000  (Band = 'Invalid < SHORT')
1048|
1049|PERCEIVED TGT:
1050|    Identification: M1A2 (Tank)
1051|    Acquisition Time:  0.10
1052|
1053|SCORING:
1054|    Detection, Recognition, and Identification
1055|
1056|
1057|CONDITION #15
1058|-------------
1059|
1060|OWN VEH:
1061|    Id: NULL_TGT (Others)
1062|    UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1063|    GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1064|    FOV: NFOV (0),  Sensor: DVO (0)
1065|
```



```
1066|BOARDS:
1067|    Board #1 Id: TB_4line (26)
1068|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1069|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1070|       GCC range: 0.000  (Band = 'Invalid < SHORT')
1071|    Board #2 Id: TB_4line (26)
1072|       UTM coord: (Zone = 0, N = 0.000, E = 0.000, Z = 0.000)
1073|       GCC coord: (X = -6323734.584, Y = 831271.616, Z = 0.000)
1074|       GCC range: 0.000  (Band = 'Invalid < SHORT')
1075|
1076|ACTUAL TGT:
1077|    NULL Target
1078|
1079|PERCEIVED TGT:
1080|    NULL Target
1081|    Acquisition Time:  0.20
1082|
1083|SCORING:
1084|    NULL Target Detected Correctly
1085|
1086|
```

```
1087|
1088|TOTALS:
1089|-------
1090|
1091|Detection:              31 (100.0 %) out of 31
1092|
1093|Recognition:            28 (90.3 %) out of 31
1094|      Tank:             5 (16.1 %)
1095|      APC:              3 (9.7 %)
1096|      Truck:            4 (12.9 %)
1097|      R/W:              7 (22.6 %)
1098|      F/W:              6 (19.4 %)
1099|      SP_Art:           3 (9.7 %)
1100|
1101|Identification:         18 (58.1 %) out of 31
1102|
1103|      M1A2:             2 (6.5 %)
1104|      LOSAT:            0 (0.0 %)
1105|      T-62:             1 (3.2 %)
1106|      T-72:             0 (0.0 %)
1107|      T-80:             0 (0.0 %)
1108|
1109|      M2A3:             0 (0.0 %)
1110|      BTR-60:           0 (0.0 %)
1111|      BMP-2:            0 (0.0 %)
1112|
1113|      HLOS:             0 (0.0 %)
1114|      HMMWV:            1 (3.2 %)
1115|      HEMTT:            0 (0.0 %)
1116|      BM-21:            0 (0.0 %)
1117|      GAZ-66:           1 (3.2 %)
1118|
1119|      P-15:             1 (3.2 %)
1120|      P-16:             0 (0.0 %)
1121|      F/A-18:           2 (6.5 %)
1122|      SU-25:            1 (3.2 %)
1123|      SU-29:            1 (3.2 %)
1124|
1125|      OH-58:            1 (3.2 %)
1126|      AH-1:             1 (3.2 %)
1127|      AH-64:            1 (3.2 %)
1128|      BAH-66:           0 (0.0 %)
1129|      MI-8:             0 (0.0 %)
1130|      MI-24:            1 (3.2 %)
1131|      MI-28:            1 (3.2 %)
1132|
1133|      BOW_M109A6:       1 (3.2 %)
1134|      MOW_2S19:         1 (3.2 %)
1135|      MORTAR_M106:      1 (3.2 %)
1136|      MORTAR_2S12:      0 (0.0 %)
1137|
1138|
1139|False Identification:           2 (5.7 %) out of 35
1140|Acquisition Time Out:            0 (0.0 %) out of 35
1141|NULL Target Detected Correctly: 2 (50.0 %) out of 4
1142|
1143|
1144|ACTUAL TESTS TAKEN:              35 (87.5 %) out of 40 conditions
1145|GT NULL Tgts:                    4 (11.4 %) out of 35
1146|GT Tgts (exclude NULL Tgts):     31 (88.6 %) out of 35
1147|GT Fully Exposed Tgts:           9 (29.0 %) out of 31
1148|GT Ball Defilade Tgts:           22 (71.0 %) out of 31
1149|Average Acquisition Time (exclude NULL Tgts):  0.19 secs out of 31 conditions
1150|
```



```
1151|
1152|RANGE BANDS:
1153|      SHORT Min     =  1602,  SHORT Max     =  1802
1154|      MEDIUM Min    =  2402,  MEDIUM Max    =  2602
1155|      LONG Min      =  3602,  LONG Max      =  3802
1156|      VERY LONG Min =  5402,  VERY LONG Max =  5602
1157|
1158|DETECTION RANGE BANDS:
1159|      Invalid Range < 1602  = 12 (38.7 %) out of 31
1160|      SHORT <= 1802         = 2 (6.5 %) out of 31
1161|      Invalid Range < 2402  = 1 (3.2 %) out of 31
1162|      MEDIUM <= 2602        = 5 (16.1 %) out of 31
1163|      LONG <= 3802          = 5 (16.1 %) out of 31
1164|      VERY LONG <= 5602     = 4 (12.9 %) out of 31
1165|      Invalid Range > 5602  = 2 (6.5 %) out of 31
1166|
1167|RECOGNITION RANGE BANDS:
1168|      Invalid Range < 1602  = 11 (35.5 %) out of 31
1169|      SHORT <= 1802         = 2 (6.5 %) out of 31
1170|      MEDIUM <= 2602        = 5 (16.1 %) out of 31
1171|      LONG <= 3802          = 4 (12.9 %) out of 31
1172|      VERY LONG <= 5602     = 4 (12.9 %) out of 31
1173|      Invalid Range > 5602  = 2 (6.5 %) out of 31
1174|
1175|IDENTIFICATION RANGE BANDS:
1176|      Invalid Range < 1602  = 9 (29.0 %) out of 31
1177|      SHORT <= 1802         = 2 (6.5 %) out of 31
1178|      MEDIUM <= 2602        = 1 (3.2 %) out of 31
1179|      LONG <= 3802          = 2 (6.5 %) out of 31
1180|      VERY LONG <= 5602     = 3 (9.7 %) out of 31
1181|      Invalid Range > 5602  = 1 (3.2 %) out of 31
1182|
```

```
1183|
1184|
1185|DETECTION FOV:
1186|      NARROW    = 24 (77.4 %) out of 31
1187|      WIDE      = 1 (3.2 %) out of 31
1188|      MEDIUM    = 0 (0.0 %) out of 31
1189|      ZOOM      = 1 (3.2 %) out of 31
1190|      UNITY     = 1 (3.2 %) out of 31
1191|      MIN_ZOOM  = 1 (3.2 %) out of 31
1192|      MAX_ZOOM  = 3 (9.7 %) out of 31
1193|
1194|RECOGNITION FOV:
1195|      NARROW    = 22 (71.0 %) out of 31
1196|      WIDE      = 1 (3.2 %) out of 31
1197|      MEDIUM    = 0 (0.0 %) out of 31
1198|      ZOOM      = 1 (3.2 %) out of 31
1199|      UNITY     = 0 (0.0 %) out of 31
1200|      MIN_ZOOM  = 1 (3.2 %) out of 31
1201|      MAX_ZOOM  = 3 (9.7 %) out of 31
1202|
1203|IDENTIFICATION FOV:
1204|      NARROW    = 16 (51.6 %) out of 31
1205|      WIDE      = 0 (0.0 %) out of 31
1206|      MEDIUM    = 0 (0.0 %) out of 31
1207|      ZOOM      = 0 (0.0 %) out of 31
1208|      UNITY     = 0 (0.0 %) out of 31
1209|      MIN_ZOOM  = 0 (0.0 %) out of 31
1210|      MAX_ZOOM  = 2 (6.5 %) out of 31
1211|
1212|
 213|
 214|DETECTION SENSOR:
1215|      DVO             = 24 (77.4 %) out of 31
1216|      FLIR            = 1 (3.2 %) out of 31
1217|      OTW             = 1 (3.2 %) out of 31
1218|      TV              = 1 (3.2 %) out of 31
1219|      I2              = 1 (3.2 %) out of 31
1220|      SEEKER FPA-IR   = 3 (9.7 %) out of 31
1221|
1222|RECOGNITION SENSOR:
1223|      DVO             = 22 (71.0 %) out of 31
1224|      FLIR            = 1 (3.2 %) out of 31
1225|      OTW             = 1 (3.2 %) out of 31
1226|      TV              = 1 (3.2 %) out of 31
1227|      I2              = 0 (0.0 %) out of 31
1228|      SEEKER FPA-IR   = 3 (9.7 %) out of 31
1229|
1230|IDENTIFICATION SENSOR:
1231|      DVO             = 15 (48.4 %) out of 31
1232|      FLIR            = 0 (0.0 %) out of 31
1233|      OTW             = 1 (3.2 %) out of 31
1234|      TV              = 0 (0.0 %) out of 31
1235|      I2              = 0 (0.0 %) out of 31
1236|      SEEKER FPA-IR   = 2 (6.5 %) out of 31
```

APPENDIX B - VV&A PDU's

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This section details the message formats used for transmitting VV&A data in DIS Action Response PDUs. There is a PDU format table corresponding to each one of the 6 Action Response PDUs customized for VV&A.

Field Size (bits)	Fields Of Action Response PDU Customized For Target Acquisition And Tracking VV&A	
96	PDU HEADER	Protocol Version - 8 bit enumeration
		Exercise ID - 8 bit unsigned integer
		PDU Type - 8 bit enumeration
		Padding - 8 bit unused
		Time Stamp - 32 bit unsigned integer
		Length - 16 bit unsigned integer
		Padding - 16 bits unused
64	ORIGINATING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
64	RECEIVING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
32	PADDING	32 bits unused
32	REQUEST ID	32 bit unsigned integer
32	REQUEST STATUS	32 bit unsigned integer
32	NUMBER OF FIXED DATUM FIELDS	0x00000000
32	NUMBER OF VARIABLE DATUM FIELDS	0x00000001
1472	TARGET ACQUISITION AND TRACKING VV&A DATA	0x0000012C (300) (See Section 4.2.2.1.2) - 32 bit unsigned int
		0x00000580 (1408) 32 bit unsigned integer
		Sight World Position - X Coordinate - 64 bit float
		Sight World Position - Y Coordinate - 64 bit float
		Sight World Position - Z Coordinate - 64 bit float
		Sight World Orientation - Psi - 32 bit float
		Sight World Orientation - Theta - 32 bit float

Sight World Orientation - Phi - 32 bit float
Gun Wrt Sight Offset - Azimuth - 32 bit float
Gun Wrt Sight Offset - Elevation - 32 bit float
Lead Sight - 8 bit unsigned integer
Active Handle - 8 bit unsigned integer
Handle Signal - 8 bit unsigned integer
Padding - 8 bits unused
Target World Position - X Coordinate - 64 bit float
Target World Position - Y Coordinate - 64 bit float
Target World Position - Z Coordinate - 64 bit float
Target World Velocity - X Coordinate - 32 bit float
Target World Velocity - Y Coordinate - 32 bit float
Target World Velocity - Z Coordinate - 32 bit float
Target Entity- Site ID - 16 bits Target Entity- Application ID - 16 bits Target Entity- Entity ID - 16 bits
Ballistic Range - 16 bit unsigned int
Ballistic Superelevation - 32 bit float
Ballistic Lead - 32 bit float
Lay Error - Azimuth - 32 bit float
Lay Error - Elevation - 32 bit float
Kinematic Lead Error - 32 bit float
Target Rate Wrt Vehicle - Azimuth -32 bit float
Target Rate Wrt Vehicle - Elevation -32 bit float
Sight Tracking Rate - Azimuth -32 bit float
Sight Tracking Rate - Elevation -32 bit float
Tracking Rate Error - Azimuth -32 bit float
Tracking Rate Error - Elevation -32 bit float
Gun World Position - X Coordinate - 64 bit float
Gun World Position - Y Coordinate - 64 bit float
Gun World Position - Z Coordinate - 64 bit float
Gun World Orientation - Psi - 32 bit float
Gun World Orientation - Theta - 32 bit float
Gun World Orientation - Phi - 32 bit float
System Induced Error - 32 bit float

Figure 121: Message Format for Action Response PDU Customized For Target Acquisition and Tracking VV&A,

Field Size (bits)	Fields Of Action Response PDU Customized For Delivery Accuracy VV&A	
96	PDU HEADER	Protocol Version - 8 bit enumeration
		Exercise ID - 8 bit unsigned integer
		PDU Type - 8 bit enumeration
		Padding - 8 bit unused
		Time Stamp - 32 bit unsigned integer
		Length - 16 bit unsigned integer
		Padding - 16 bits unused
64	ORIGINATING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
64	RECEIVING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
32	PADDING	32 bits unused
32	REQUEST ID	32 bit unsigned integer
32	REQUEST STATUS	32 bit unsigned integer
32	NUMBER OF FIXED DATUM FIELDS	0x00000000
32	NUMBER OF VARIABLE DATUM FIELDS	0x00000001
8576	DELIVERY ACCURACY VV&A DATA	0x0000012D (301) (See Section 4.2.2.1.2) - 32 bit unsigned int
		0x00002140 (8512) 32 bit unsigned integer
		Sight World Position - X Coordinate - 64 bit float
		Sight World Position - Y Coordinate - 64 bit float
		Sight World Position - Z Coordinate - 64 bit float
		Sight World Orientation - Psi - 32 bit float
		Sight World Orientation - Theta - 32 bit float
		Sight World Orientation - Phi - 32 bit float
		Gun Wrt Sight Offset - Azimuth - 32 bit float
		Gun Wrt Sight Offset - Elevation - 32 bit float
		Time At Firing - 32 bit unsigned integer
		Lead Sight - 8 bit unsigned integer
		Target Hit Status - 8 bits unsigned integer
		Fire Event - Site ID - 16 bits Fire Event - Application ID - 16 bits Fire Event - Event ID - 16 bits
		Target World Position - X Coordinate - 64 bit float
		Target World Position - Y Coordinate - 64 bit float

Target World Position - Z Coordinate - 64 bit float
Target World Velocity - X Coordinate - 32 bit float
Target World Velocity - Y Coordinate - 32 bit float
Target World Velocity - Z Coordinate - 32 bit float
Target Entity- Site ID - 16 bits Target Entity- Application ID - 16 bits Target Entity- Entity ID - 16 bits
Ballistic Range - 16 bit unsigned int
Ballistic Superelevation - 32 bit float
Ballistic Lead - 32 bit float
Ballistic Cant - 32 bit float
Ballistic Barometric Pressure - 32 bit float
Ballistic Crosswind Direction From North - 32 bit float
Ballistic Crosswind Magnitude - 16 bit integer
Ballistic Ammo Temperature - 16 bit integer
Ballistic Air Temperature - 16 bit integer
Environment Ammo Temperature - 16 bit integer
Environment Air Temperature - 16 bit integer
Environment Crosswind Magnitude - 16 bit integer
Environment Crosswind Direction From North - 32 bit float
Environment Barometric Pressure - 32 bit float
Kinematic Lead Error - 32 bit float
Lay Error - Azimuth - 32 bit float
Lay Error - Elevation - 32 bit float
Lay Point World Position - X Coordinate - 64 bit float
Lay Point World Position - Y Coordinate - 64 bit float
Lay Point World Position - Z Coordinate - 64 bit float
Target Rate Wrt Vehicle - Azimuth -32 bit float
Target Rate Wrt Vehicle - Elevation -32 bit float
Sight Tracking Rate - Azimuth -32 bit float
Sight Tracking Rate - Elevation -32 bit float
Tracking Rate Error - Azimuth -32 bit float
Tracking Rate Error - Elevation -32 bit float

Gun World Position - X Coordinate - 64 bit float
Gun World Position - Y Coordinate - 64 bit float
Gun World Position - Z Coordinate - 64 bit float
Gun World Orientation - Psi - 32 bit float
Gun World Orientation - Theta - 32 bit float
Gun World Orientation - Phi - 32 bit float
Gun World Orientation With All But Static Round Dispersion - Psi - 32 bit float
Gun World Orientation With All But Static Round Dispersion - Theta - 32 bit float
Gun World Orientation With All But Static Round Dispersion - Phi - 32 bit float
Gun World Orientation With All Dispersions - Psi - 32 bit float
Gun World Orientation With All Dispersions - Theta - 32 bit float
Gun World Orientation With All Dispersions - Phi - 32 bit float
System Induced Error - 32 bit float
Time Of Flight To Target Range - 32 bit float
Firer-Target Mobility Status - 8 bit uns. int.
Padding - 24 bits unused
Fixed Bias - Horizontal - 32 bit float
Fixed Bias - Vertical - 32 bit float
Occasion Dispersion - Horizontal - 32 bit float
Occasion Dispersion - Vertical - 32 bit float
Static Round Dispersion - Horizontal - 32 bit float
Static Round Dispersion - Vertical - 32 bit float
Dynamic SM Dispersion Add-On - Horizontal - 32 bit float
Dynamic SM Dispersion Add-On - Vertical - 32 bit float
Dynamic MS Dispersion Add-On - Horizontal - 32 bit float
Dynamic MS Dispersion Add-On - Vertical - 32 bit float
Gun Pointing Error - Horizontal - 32 bit float
Gun Pointing Error - Vertical - 32 bit float
Total Gun Pointing Error - Horizontal - 32 bit float
Total Gun Pointing Error - Vertical - 32 bit float
Total System Error - Horizontal - 32 bit float

Total System Error - Vertical - 32 bit float
Miss Distance - Horizontal - 32 bit float
Miss Distance - Vertical - 32 bit float
Gun Direction Wrt Desired Aimpoint - Horizontal - 32 bit float
Gun Direction Wrt Desired Aimpoint - Vertical - 32 bit float
Vehicle World Velocity - X Component - 32 bit float
Vehicle World Velocity - Y Component - 32 bit float
Vehicle World Velocity - Z Component - 32 bit float
Vehicle World Acceleration - X Component - 32 bit float
Vehicle World Acceleration - Y Component - 32 bit float
Vehicle World Acceleration - Z Component - 32 bit float
Vehicle Angular Velocity - X Component - 32 bit float
Vehicle Angular Velocity - Y Component - 32 bit float
Vehicle Angular Velocity - Z Component - 32 bit float
Padding - 32 bits unused
Actual Trajectory-Target Plane Intersection World Position - X Coordinate - 64 bit float
Actual Trajectory-Target Plane Intersection World Position - Y Coordinate - 64 bit float
Actual Trajectory-Target Plane Intersection World Position - Z Coordinate - 64 bit float
Padding - 64 bits unused
Actual Flyout Trajectory - 2560 bit Trajectory-Record
Flyout Trajectory With out Dispersions - 2560 bit Trajectory-Record

Figure 122: Message Format for Action Response PDU Customized For Delivery Accuracy VV&A.

Field Size (bits)	Fields Of Action Response PDU Customized For Direct Fire Vulnerability Assessment VV&A	
96	PDU HEADER	Protocol Version - 8 bit enumeration
		Exercise ID - 8 bit unsigned integer
		PDU Type - 8 bit enumeration
		Padding - 8 bit unused
		Time Stamp - 32 bit unsigned integer
		Length - 16 bit unsigned integer
		Padding - 16 bits unused
64	ORIGINATING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
64	RECEIVING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
32	PADDING	32 bits unused
32	REQUEST ID	32 bit unsigned integer
32	REQUEST STATUS	32 bit unsigned integer
32	NUMBER OF FIXED DATUM FIELDS	0x00000000
32	NUMBER OF VARIABLE DATUM FIELDS	0x00000001
1472	DIRECT FIRE VULNERABILITY ASSESSMENT VV&A DATA	0x0000012E (302) (See Section 4.2.2.1.2) - 32 bit unsigned int
		0x00000580 (1408) 32 bit unsigned integer
		Direct Fire Type - 8 bits unsigned int
		Padding - 8 bits unused
		Range From Firer At Firing - 16 bit us integer
		Fire Event - Site ID - 16 bit uns. integer Fire Event - Application ID - 16 bit uns. int. Fire Event - Event ID - 16 bit uns. int.
		Firing Entity - Site ID - 16 bit uns. integer Firing Entity- Application ID - 16 bit uns. int. Firing Entity - Entity ID - 16 bit uns. int.
		DIS Munition Type - 64 bit Entity Type Record
		Impact Location Vehicle Position - X Coordinate - 64 bit float
		Impact Location Vehicle Position - Y Coordinate - 64 bit float
		Impact Location Vehicle Position - Z Coordinate- 64 bit float
		Impact Azimuth - 32 bit float
		Dispersion Of Impacting Round - 32 bit float
		Exposure Mode - 8 bit unsigned int
		Padding - 24 bits unused
		STAFF Submunition Attack Azimuth - 32 bit float
		STAFF Submunition Attack Elevation - 32 bit float
		M-Kill Probability - 32 bit float

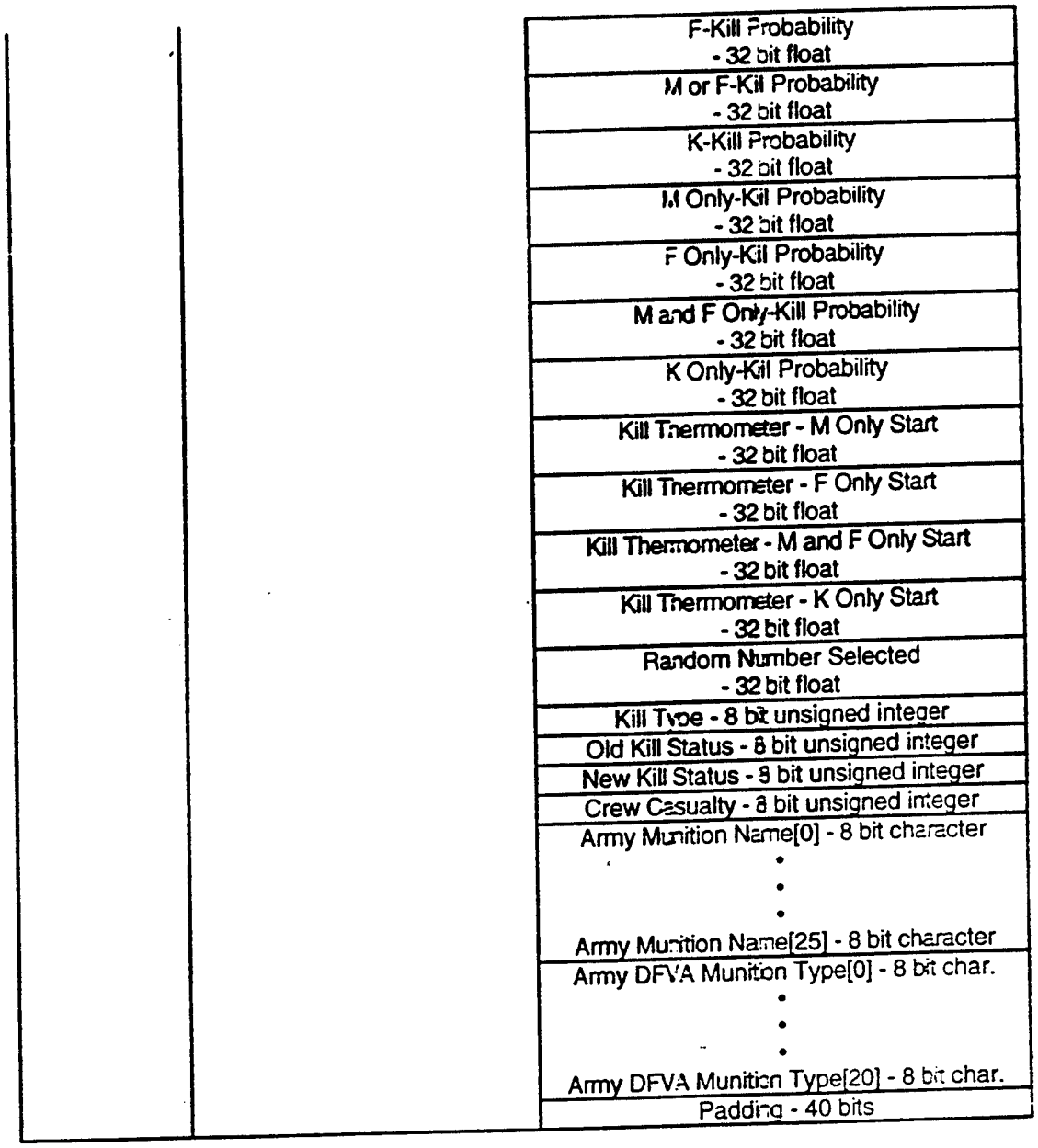

Figure 123: Message Format for Action Request PDU Customized For Direct Fire Vulnerability VV&A.

Field Size (bits)	Fields Of Action Response PDU Customized For Indirect Vulnerability Assessment VV&A	
96	PDU HEADER	Protocol Version - 8 bit enumeration
		Exercise ID - 8 bit unsigned integer
		PDU Type - 8 bit enumeration
		Padding - 8 bit unused
		Time Stamp - 32 bit unsigned integer
		Length - 16 bit unsigned integer
		Padding - 16 bits unused
64	ORIGINATING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
64	RECEIVING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
32	PADDING	32 bits unused
32	REQUEST ID	32 bit unsigned integer
32	REQUEST STATUS	32 bit unsigned integer
32	NUMBER OF FIXED DATUM FIELDS	0x00000000
32	NUMBER OF VARIABLE DATUM FIELDS	0x00000001
2240	INDIRECT FIRE VULNERABILITY ASSESSMENT VV&A DATA	0x0000012F (303) (See Section 4.2.2.1.2) - 32 bit unsigned int
		0x00000880 (2176) 32 bit unsigned integer
		Indirect Fire Type - 8 bit unsigned int
		Environment Type - 8bit unsigned integer
		Exposure Type - 8 bit unsigned integer
		Damage Function Selected - 8 bit unsigned integer
		Kill Type - 8 bit unsigned integer
		Environment Type - 8 bit unsigned integer
		Exposure Type - 8 bit unsigned integer
		Padding - 8 bits unused
		Vehicle World Position - X Coordinate - 64 bit float
		Vehicle World Position - Y Coordinate - 64 bit float
		Vehicle World Position - Z Coordinate - 64 bit float
		Detonation World Position - X Coordinate - 64 bit float

Detonation World Position - Y Coordinate - 64 bit float
Detonation World Position - Z Coordinate - 64 bit float
DIS Munition Type - 64 bit Entity Type Record
DIS Fuze Type - 16 bit unsigned int
Padding - 16 bits unused
Environment Scalar - 32 bit float
Exposure Scalar For M-Kill - 32 bit float
Exposure Scalar For F-Kill - 32 bit float
Exposure Scalar For M or F-Kill - 32 bit float
Exposure Scalar For K-Kill - 32 bit float
Lethal Area For M-Kill - 32 bit float
Lethal Area For F-Kill - 32 bit float
Lethal Area For M or F-Kill - 32 bit float
Lethal Area For K-Kill - 32 bit float
HEM Initial Kill Probability - 32 bit float
HEM RATS Value - 32 bit float
Detonation Wrt Vehicle Offset In Range - 32 bit float
Detonation Wrt Vehicle Offset In Deflection - 32 bit float
ICM Number Of Submunitions - 16 bit float
Padding - 16 bits unused
ICM Reliability - 32 bit float
Firer-Detonation Range - 32 bit float
Pattern Cutoff Radius - 32 bit float
M-Kill Probability - 32 bit float
F-Kill Probability - 32 bit float
M or F-Kill Probability - 32 bit float
K-Kill Probability - 32 bit float
M Only-Kill Probability - 32 bit float
F Only-Kill Probability - 32 bit float
M and F Only-Kill Probability - 32 bit float

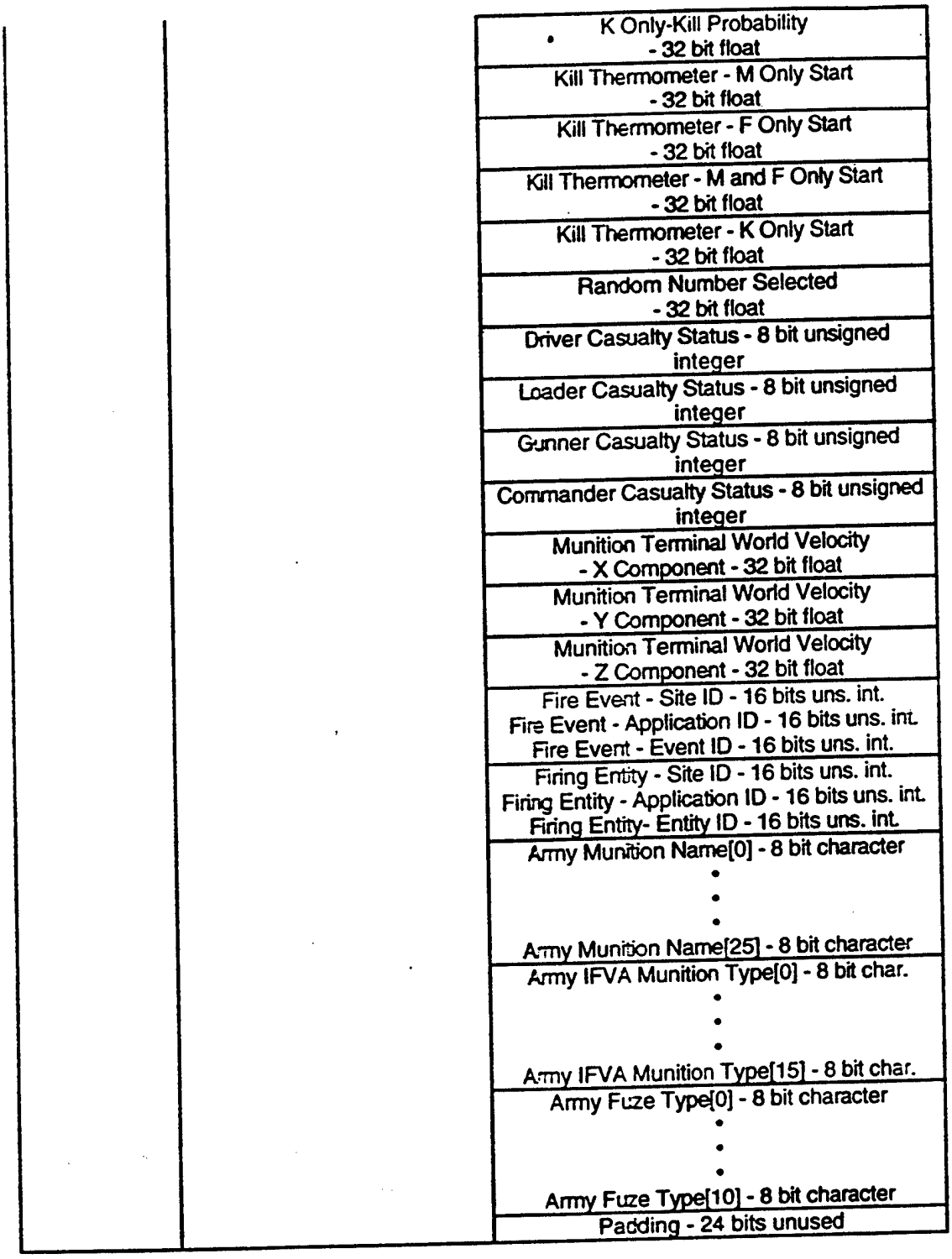

Figure 124: Message Format for Action Response PDU Customized For Indirect Fire Vulnerability VV&A.

Field Size (bits)	Fields Of Action Response PDU Customized For Coax Gun VV&A	
96	PDU HEADER	Protocol Version - 8 bit enumeration
		Exercise ID - 8 bit unsigned integer
		PDU Type - 8 bit enumeration
		Padding - 8 bit unused
		Time Stamp - 32 bit unsigned integer
		Length - 16 bit unsigned integer
		Padding - 16 bits unused
64	ORIGINATING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
64	RECEIVING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
32	PADDING	32 bits unused
32	REQUEST ID	32 bit unsigned integer
32	REQUEST STATUS	32 bit unsigned integer
32	NUMBER OF FIXED DATUM FIELDS	0x00000000
32	NUMBER OF VARIABLE DATUM FIELDS	0x00000001
1408	COAX GUN VV&A DATA	0x00000130 (304) (See Section 4.2.2.1.2) - 32 bit unsigned int
		0x00000540 (1344) 32 bit unsigned integer
		Lay Error - Azimuth - 32 bit float
		Lay Error - Elevation - 32 bit float
		Lay Point World Position - X Coordinate - 64 bit float
		Lay Point World Position - Y Coordinate - 64 bit float
		Lay Point World Position - Z Coordinate - 64 bit float
		Sight World Position - X Coordinate - 64 bit float
		Sight World Position - Y Coordinate - 64 bit float
		Sight World Position - Z Coordinate - 64 bit float
		Sight World Orientation - Psi - 32 bit float
		Sight World Orientation - Theta - 32 bit float
		Sight World Orientation - Phi - 32 bit float
		Lead Sight - 8 bit unsigned integer
		Padding - 24 bits unused
		Target World Position - X Coordinate - 64 bit float
		Target World Position - Y Coordinate - 64 bit float

		Target World Position - Z Coordinate - 64 bit float
		Target Entity- Site ID - 16 bits Target Entity- Application ID - 16 bits Target Entity- Entity ID - 16 bits
		Firer-Target Mobility Status - 8 bit uns. int.
		Target Hit Status - 8 bit uns. int.
		Detonation World Position - X Coordinate - 64 bit float
		Detonation World Position - Y Coordinate - 64 bit float
		Detonation World Position - Z Coordinate - 64 bit float
		Fixed Bias - Horizontal - 32 bit float
		Fixed Bias - Vertical - 32 bit float
		Burst Dispersion - Horizontal - 32 bit float
		Burst Dispersion - Vertical - 32 bit float
		Static Round Dispersion - Horizontal - 32 bit float
		Static Round Dispersion - Vertical - 32 bit float
		Dynamic SM Dispersion Add-On - Horizontal - 32 bit float
		Dynamic SM Dispersion Add-On - Vertical - 32 bit float
		Dynamic MS Dispersion Add-On - Horizontal - 32 bit float
		Dynamic MS Dispersion Add-On - Vertical - 32 bit float

Figure 125: Message Format for Action Response PDU Customized For Coax Gun VV&A

Field Size (bits)	Fields Of Action Response PDU Customized For STAFF Round VV&A	
96	PDU HEADER	Protocol Version - 8 bit enumeration
		Exercise ID - 8 bit unsigned integer
		PDU Type - 8 bit enumeration
		Padding - 8 bit unused
		Time Stamp - 32 bit unsigned integer
		Length - 16 bit unsigned integer
		Padding - 16 bits unused
64	ORIGINATING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
64	RECEIVING ENTITY ID	Site - 16 bit unsigned integer Application - 16 bit unsigned integer Entity - 16 bit unsigned integer Group -16 bit unsigned integer
32	PADDING	32 bits unused
32	REQUEST ID	32 bit unsigned integer
32	REQUEST STATUS	32 bit unsigned integer
32	NUMBER OF FIXED DATUM FIELDS	0x00000000
32	NUMBER OF VARIABLE DATUM FIELDS	0x00000001
1472	STAFF ROUND VV&A DATA	0x00000131 (305) (See Section 4.2.2.1.2) - 32 bit unsigned int
		0x00000580 (1408) 32 bit unsigned integer
		STAFF Fire Event - Site ID - 16 bit us int STAFF Fire Event - Applic. ID - 16 bit us int STAFF Fire Event - Event ID - 16 bit us int
		STAFF Range - 16 bit unsigned integer
		Seeker Activation Range - 16 bit us integer
		Seeker Activation Status - 8 bit us integer
		Submunition Fire Status - 8 bit us integer
		Time At STAFF Firing - 32 bit us integer
		Time At Seeker Activation - 32 bit us integer
		Time At Submunition Firing - 32 bit us integer
		STAFF Reliability - 32 bit float
		Random Number Drawn Against Reliability - 32 bit float
		Antenna Beam Azimuth - 32 bit float
		Forward Look Angle - 32 bit float
		Range From Vehicle At Submunition Firing - 16 bit us int
		Target Entity - Site ID - 16 bit unsigned int Target Entity - Application ID - 16 bit us int Target Entity - Entity ID - 16 bit unsigned int
		Target World Position - X Coordinate - 64 bit float
		Target World Position - Y Coordinate - 64 bit float
		Target World Position - Z Coordinate - 64 bit float

Target World Orientation - Psi - 32 bit float
Target World Orientation - Theta - 32 bit float
Target World Orientation - Phi - 32 bit float
Number Of Targets Detected - 16 bits us int
Firer-Target Mobility Status - 8 bit uns. int.
Padding - 8 bits unused
Submunition Firing Location- X Coordinate - 64 bit float
Submunition Firing Location - Y Coordinate - 64 bit float
Submunition Firing Location - Z Coordinate - 64 bit float
Submunition Detonation Location - X Coordinate - 64 bit float
Submunition Detonation Location - Y Coordinate - 64 bit float
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Aimpoint Bias - Vertical - 32 bit float
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Dynamic SM Dispersion Add-On - Vertical - 32 bit float
Dynamic MS Dispersion Add-On - Horizontal - 32 bit float
Dynamic MS Dispersion Add-On - Vertical - 32 bit float

Figure 126: Message Format for Action Response PDU Customized For STAFF Round VV&A.

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APPENDIX C - VV&A TEST DESIGN SAMPLES

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1. OVERVIEW

This Appendix gives an overview of a portion of the M1A2 VV&A Evaluation Plan and Test Design Plan for Target Acquisition and Delivery Accuracy. The purpose of this Appendix is to provide a frame of reference for the use of the simulator VV&A tools.

2. TARGET ACQUISITION

The M1A2 acquisition sensors are visually presented to the commander, gunner and driver through a Computer Image Generator (CIG). Target Acquisition is the ability to detect, recognize and identify targets; however the CIG must first accurately portray/present the targets and surrounding environment for a specific sensor device. For example the CIG must adequately portray a Forward Looking Infrared (FLIR) sensor and how that FLIR (i.e. CIG image) presents the scene to the viewer (gunner, etc). Validation of the Computer Image Generator and validation of Target Acquisition are closely linked.

Issue: How well does the M1A2 simulator's level 2 Computer Image Generator render realistic scenes for each sensor based on the environment to include terrain, cultural features and icons ?

Criteria: CIG evaluation will be evaluated by Subject Matter Experts

Issue: How well does the M1A2 simulator's target acquisition capability permit the crew to detect, recognize and identify targets ?

Criteria: Ability of the simulator crew (man-in-the-loop) to detect, recognize and identify targets must be characteristic of the M1A2 system requirements and system performance. Results will also be compared to NVESD model estimates.

The M1A2 employs four sensors as described below:

(1) The commander and gunner are equipped with the Gunner Primary Sight (GPS) which displays the Direct View Optics (DVO) in Wide Field of View (WFOV) or Narrow field of View (NFOV).

(2) The GPS is also switchable to the Thermal Imaging System (TIS) which can be magnified to WFOV or NFOV.

(3) The commander is equipped with an independent thermal flat panel display, the Commanders Independent Thermal Viewer (CITV), which operates in WFOV or NFOV.

(4) The driver is equipped with three forward looking vision blocks, i.e. out-the-window view. The commander also has three vision blocks located in the cupola. The cupola/vision blocks can be rotated around 360 degrees to provide the commander with a 360 degree view.

2.1 Test Plan

The following tests will be conducted to validate CIG performance and Target Acquisition capability:

2.1.1 CIG Characterization and Icon Representation.

The terrain, cultural features and icons must be sufficiently representative of the real world being depicted. Each icon should have the same level of fidelity/detail so that target acquisition is not unduly influenced. Furthermore there should not be any unrealistic cues, such as color, which readily distinguish friendly versus enemy targets. Subject Matter Experts will qualitatively assess the CIG and Icon Representation.

2.1.2 Target Acquisition In-field-of-View - Vehicle Target Icons.

Table 1 contains the target acquisition test matrix for the terrain, cultural features and icons. Four M1A2 qualified gunners and/or commanders will detect, recognize and identify six targets. Pairs of targets were chosen from three target classes. The six targets will consist of: a tank class - M1A2 Abrams and the T80; an infantry track vehicle class - M2A2 Bradley and the BMP2; a light wheeled vehicle class - HMMWV and BTR-60. Each target will be presented in four range bands, which are: short range (1600-1800 meters); medium range (2300-2500 meters); long range (3600-3800 meters); very long range (5400-5600 meters). Additionally null targets will appear in a randomly ordered sequence. The environmental conditions include: day 7km visibility; day with 3.5km visibility; and night. These various conditions will be replicated on different backgrounds and clutter. The number of replications conducted is a function of the environmental condition.

Each gunner will look through a given sensor and magnification (e.g. TIS (N)). One target will be presented in a certain range band and under a certain environmental condition. The gunner will attempt to acquire the target to the highest level of acquisition possible. The acquisition scale in ascending order is: no detection, detection, recognition (i.e. Tank Class, APC Class, Truck Class, Air Class), identification (e.g. M1A2, BMP2, etc.). Additionally a quadrant will be drawn on the sight glass, so that the target appears to be in one of the quadrants: far left, middle left, middle right, and far right. During the test execution, for example, a gunner will be presented with one target and he will state "M1A2 far right quadrant".

2.1.3 Target Acquisition In-field-of-View - Line Pair Boards.

The standard 2.3 by 2.3 meter line-pair target boards for detection, recognition and identification will be presented to four test gunners. The boards will be randomly spaced within four range bands. Only one board will be presented at any one time. Gunners will vocally announce the number of line-pairs that are discernable and the orientation of the lines "horizontal" or "vertical". The Target Board Test Matrix is contained in Table 1.

Table 1. Target Acquisition Test Cases

ENVIRONMENT	SENSORS					
	DVO (N)	DVO (W)	TIS (N)	TIS (W)	CITV (N)	CITV (W)
Day 7km Visibility	X	X B	X B	X	X B	X
Day 3.5km Visibility	Y	Y B	Y B	Y	Y B	Y
Night	NONE	NONE	Y B	Y	Y	Y

Notes:
X = 4 simulators (i.e. gunners/commanders), 6 targets, 4 ranges, 5 replications
Y = 4 simulators (i.e. gunners/commanders), 6 targets, 4 ranges, 2 replications
B = Line-pair Board Test

2.2 Data Required

The following data will be collected:

- the condition presented
  - environment (e.g. day 7km visibility, etc)
  - sensor (e.g. DVO(N), etc)
  - target (e.g. M1A2, T80, line-pair board, etc)
  - range and range band (e.g. 1620 meters, short range band)
  - observer vehicle location (X, Y, Z, heading)
  - observer sight location (X, Y, Z, heading)
  - target vehicle location (X, Y, Z, heading)
  - aspect angle of target relative to observer sight location
- gunner acquisition response
- gunner quadrant response
- gunner time (seconds) to determine highest level of acquisition

The target acquisition test will be conducted with the use of the Verification, Validation and Accreditation Test Tool (VVATT). Data will be captured by Standard Protocol Data Units (PDUs), the Target Acquisition VV&A PDUs and the VVATT.

2.3 Evaluation Plan

The data will be aggregated over both similar and varying conditions. Time to acquire and probabilities of detection, recognition, identification and false targets will be determined as a function of similar and varying conditions. Results will be compared: across conditions, to NVESD model estimates and to system requirements for acquisition.

3. DELIVERY ACCURACY

Issue: How well does the M1A2 simulator simulate the 120mm Sabot and HEAT rounds' delivery accuracy ?

Criteria: The simulated delivery accuracy must be comparable to demonstrated round performance from actual M1A2 technical tests and/or AMSAA analytical estimates.

The M1A2 Abrams tank M256 120mm main gun fire control attempts to simply point the gun so that a round, when fired, will hit the target aimpoint. The Abrams takes into account the offset of the sight to gun, air temperature, air pressure, cant, propellant temperature, crosswind, distance to target, gravity and the relative crossing motion of the target and Abrams. The fire control does not account for coriolis, but this influence is small. In practice, the fire control solution is only approximate because of differences between the actual tank environment and the sensed environment. Fire control errors are attributable to tracking errors, own-vehicle motion disturbances getting through the stabilizer, gun pointing errors (actual hardware), variations in ammunition size, shape, weight, integrity, yaw, muzzle velocity, launch characteristics, gun vibrations and influences. These unpredictable variations are characterized empirically by their statistical distributions.

Delivery accuracy is defined in terms of a distance from a desired aimpoint. This is called "total system error" and is the distance between the projectile and the desired aimpoint in the vertical plane, which is normal to the line of sight to the target and contains the desired aimpoint. Total system error is expressed as an angle. If the actual aimpoint and the desired aimpoint do not coincide, the angular distance between the two is termed "lay error". Lay error subtracted from the total system error, is termed the projectile "miss distance". Hitting probability is the result of integrating the total system error density function over the presented vertical target area, a projection of the target outline in a vertical plane containing the desired aimpoint.

3.1 Test Plan

Delivery accuracy tests are divided into four major scenarios:

1.) stationary firer versus stationary target,

2.) moving firer versus stationary target,

3.) stationary firer versus moving target,

4.) moving firer versus moving target.

In all scenarios, except moving firer versus moving target, a 2.3m x 2.3m vertical target centered on a 10m x 10m panel is used. In the moving firer versus moving target scenario, a 2.3m x 4.6m target is used. A clearly defined aimpoint is marked on each target. The gunner should follow established engagement procedures defined in the M1A2 training manual. Engagement procedures should mirror the FM 17-12 series manual as closely as possible, including ranging to target just before trigger pull.

3.1.1 Stationary Firer versus Stationary Target

Table 2 shows the stationary firer versus stationary target test matrix. In each case, the target is located out of the M1A2's narrow field of view. The gunner engages the target, and then fires a second round. The gunner continues finding targets until 60 shots have been accumulated for the engagement range.

Table 2 - Stationary Firer versus Stationary Target Test Matrix

Range (m)	Shots per Target	Number of Targets
1500	2	30
2500	2	30
3000	2	30
3500	2	30

3.1.2 Moving Firer versus Stationary Target

The moving firer versus stationary target test matrix is contained in Table 3. In the 20 kph head-on case, the M1A2 moves toward the target. The range to the target at the start of the run should be 0.5 km to 1 km farther than the engagement range. In the 20 kph crossing case, the M1A2 moves crosswise to the target.

Table 3 - Moving Firer versus Stationary Target Test Matrix

Firer Speed (kph)	Range (m)	Shots per Rep	Number of Reps
20 kph Head-on	1000	2	30
	1500	2	30
	2000	2	30
	2500	2	30
20 kph Crossing	1000	2	30
	1500	2	30

3.1.3 Stationary Firer versus Moving Target

Table 4 shows the stationary firer versus moving target test matrix. The target must remain perpendicular to the firer and the elevation of the aimpoint must remain constant. The test environment should emulate the Aberdeen Proving Ground's Bubble Moving Target Simulator.

Table 4 - Stationary Firer versus Moving Target Test Matrix

Target Path	Target Speed (kph)	Range (m)	Shots per Rep	Number of Reps
CV20	20	1500	2	30
		2000	2	30
		2500	2	30
ATMT	Variable	1500	10-20	10
		2000	10-20	10
		2500	10-20	10

CV20 is a constant speed crossing target. The ATMT path is a maneuvering combat path running for 273 seconds. In all cases the range will be kept constant. The gunner aims at the center of the target, tracks smoothly, and fires when he feels confident of hitting the target. Additional shots should be taken with the objective of being accurate.

3.1.4 Moving Firer versus Moving Target

The moving firer versus moving target test matrix is contained in Table 5. For the actual M1A2 system, this case is treated by combining stationary firer-moving target accuracy with the add-on dispersion for fire-on-the-move.

Table 5 - Moving Firer versus Moving Target Test Matrix

Crossing Speed (kph)		Range (m)	Shots per Rep	Number of Reps
Firer	Target*			
10	10	1500	3	20
* 2.3m X 4.6m vertical target				

3.2 Data Required

Following are the individual data elements required for all the delivery accuracy tests. For the stationary firer versus stationary target tests, the data elements are not required as a function of time, but rather as a function of trigger pull.

- Desired aimpoint coordinates with respect to an earth reference (w/r/t/e), x,y,z, in meters, versus time in 1/10 second intervals.
- Origin of the sight line on the simulator w/r/t/e, x,y,z in meters, versus time in 1/10 second intervals.
- Midpoint of the gun trunnion w/r/t/e, x,y,z in meters, versus time in 1/10 second intervals.
- Lay error, the desired aimpoint w/r/t the midpoint of the sight reticle in mrads, horizontal and vertical, versus time in 1/10 second intervals.
- Gun pointing direction, at trunnion, w/r/t desired aimpoint in mrads, horizontal and vertical, versus time in 1/10 second intervals.

- Inputs to the fire control computer: range(m), cant(mrad), crosswind(m/sec), propellant temperature(°F), air temperature(°F), air pressure(inches Hg), boresight values(mrads), computer correction factor(s) (mrads).
- Actual meteorological conditions, if different from those in f above.
- Ballistic solution (mrads), horizontal and vertical - where the fire control wants to point the gun axis at the trunnion, w/r/t the boresight line.

- Actual trajectory of the projectile at 500m increments, desired by horizontal range(m), height(m), and deflection(m), out to, and including the point of closest approach to the aimpoint.
- Projectile's time-of-flight as a function of the trajectory.
- Sight pointing, and gun pointing direction at the trunnion, w/r/t the desired aimpoint at trigger pull time, in mrads, horizontal and vertical. Tag these measurements with the trigger pull times.
- Gun-to-Sight offset, the difference between sight pointing and gun pointing directions.
- Total system error, equals the projectile location minus the desired aimpoint.
- Projectile miss distance at the point of closest approach to the desired aimpoint. Miss distance equals the total system error minus lay error. Express the miss distance in terms of horizontal and vertical deflections (m).
- Number of hits and Number of shots

Additional data items required under the stationary firer versus moving target condition and the moving firer versus moving target conditions are:

- Velocity of the desired aimpoint w/r/t/e, dx/dt, dy/dt, dz/dt, in m/sec, versus time in 1/10 second intervals.
- Target's instantaneous rate

Additional data items required under the stationary firer versus moving target, moving firer versus stationary target, and moving firer versus moving target conditions are:

- azimuth linear lead required, equals the target's instantaneous rate multiplied by the projectile's time of flight.
- kinematic lead error, equals azimuth gun-to-sight offset minus the linear lead required
- system induced error, equals kinematic lead error plus the lay error

The delivery accuracy test will be conducted with the use of the Delivery Accuracy Logger files, in order to present the scenario. Data will be captured by Standard Protocol Data Units (PDUs), the Target Acquisition and Tracking VV&A PDUs, and the Delivery Accuracy VV&A PDU's.

3.3 Evaluation Plan

The mean and standard deviation of each group's miss distances, lay errors, total system errors, etc. will be calculated. The grand mean and overall standard deviation will also be computed.

All the delivery accuracy statistics will be compared to the M1A2 technical test results, analytical estimates and quasi-combat values. The gun-to-sight offset will be compared to the fire control sensor inputs and manual inputs.

APPENDIX D - DISTRIBUTION

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AMXSY-CD

STUDY GIST

SUBJECT: Technical Report Number: 570, Anti-Armor Advanced Technology Demonstration (A2 ATD) Verification, Validation and Accreditation (VV&A) Tools for Simulators.

PRINCIPAL FINDINGS: See Objectives below.

MAIN ASSUMPTIONS: Prior to the execution of the Anti-Armor Advanced Technology Demonstration (A2 ATD) Distributed Interactive Simulation (DIS) Experiments all the individual models/elements of the DIS Experiment must first be verified, validated and accredited (VV&A). The simulators and Modular Semi-automated Force (MODSAF) need to be VV&A'd before the experiment. Additionally the entire Experiment needs to be VV&A'd.

PRINCIPLE LIMITATIONS/SCOPE OF EFFORT: The VV&A tools contained in this report are based on the M1A2 simulator. However, these tools are sufficiently general that they transfer/adapt well to other weapon systems/simulators. For example, nearly all weapon systems/simulators require a gunner to detect, recognize and identify targets; therefore, the M1A2 simulator VV&A methodology and tools developed to capture target acquisition capabilities are transferable.

OBJECTIVES: The Anti-armor Advanced Technology Demonstration is a series of Battlefield Distributed Simulation - Developmental (BDS-D) experiments focusing on A2 weapon systems evaluations. A2 ATD Experiments consist of a combination of one or more simulators coupled with MODSAF. Each combination requires VV&A of: individual simulators, MODSAF and the entire BDS-D simulation. Under the A2 ATD program, methodologies and tools have been designed and developed to assist in the VV&A process of individual simulators, MODSAF and the BDS-D simulation. This report outlines and describes the VV&A methodologies and tools developed and demonstrated for an individual simulator.

BASIC APPROACH: Since the purpose of A2 ATD centers on weapon systems evaluations, then the VV&A tools are also geared toward that end. The tools are:

1.) VV&A Test Tool for target acquisition tests;

2.) VV&A Protocol Data Units for target acquisition, tracking, delivery accuracy, direct fire vulnerability, indirect fire vulnerability, Smart Target Acquisition Fire and Forget (STAFF) round, coax machinegun;

3.) Delivery Accuracy Logger Files for test scenarios;

4.) DIS Analytical Tools to format and output results;

5.) Simulation Manager for setting certain data items in the simulator (e.g. fuel quantity).

In the future, the VV&A tools will continue to evolve and mature. Additionally other tools will be developed to streamline the VV&A process.

REASON FOR PERFORMING THE STUDY OR ANALYSIS: Historically, the analytical community has used constructive models such as Janus and CASTFOREM to conduct analysis for the acquisition process. These types of models do not fully represent the impacts of human interaction with the system and the human influence on combat effectiveness of the system. The Training and the Research and Development communities have used real time man-in-the-loop DIS for several years. However, the full potential of DIS as an evaluation tool to support materiel acquisition decisions has not been realized; A2 ATD will explore the use of DIS as an evaluation tool. As one feeder into the use of DIS as an evaluation tool, each simulator participating in the experiment must be VV&A'd.

IMPACT OF THE STUDY/PLAN: The A2 ATD VV&A Tools for Simulators provides a blueprint for use in methodology, data collection and analysis to support simulator VV&A. These activities provide "credible" simulator responses/results and therefore provide the overall experiment with "credible" outcomes.

SPONSOR: This effort is sponsored by the Headquarters, Department of the Army, Assistant Secretary of the Army for Research, Development and Acquisition.

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NAME/ADDRESS/PHONE NUMBER WHERE COMMENTS AND QUESTIONS CAN BE SENT: Director, AMSAA, ATTN: AMXSY-CD (Irene Johnson), Aberdeen Proving Ground, MD 21005-5071 (DSN 298-6608 or 410-278-6608).

DEFENSE TECHNICAL INFORMATION CENTER (DTIC) ACCESSION NUMBER OF FINAL REPORT: Report available by contacting AMSAA's Reports Processing Center, DSN 298-5676.

OTHER THAN THE SPONSOR, WHO COULD BENEFIT FROM THIS STUDY INFORMATION ? Other DoD personnel and their contractors involved in the acquisition process, DIS experiments, simulators, computer generated forces, and/or VV&A of DIS.